

To face the Title.



A. Motte sculp.

He spake of trees, from the cedar-tree that is in Lebanon, even unto the hyssop that springeth out of the wall; he spake also of beasts, and of fowl, and of creeping things, and of fishes. 1 Kings 4.33.

Spectacle de la Nature :

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NATURE DISPLAY'D.

B E I N G

DISCOURSES

On such PARTICULARS of

NATURAL HISTORY

As were thought most proper

To EXCITE the CURIOSITY,

A N D

FORM the Minds of YOUTH.

Illustrated with COPPER PLATES.

Translated from the Original French.

L O N D O N :

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C. DAVIS in *Pater-noster Row*.

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THE PREFACE.



Of all the Methods capable of being practised with Success, for cultivating the Understanding of young Persons, and giving them an early Habit of Thinking ; there are none that produce more sure and lasting Effects than Curiosity. The Desire of Knowledge is as natural to us as Reason, it exerts itself with Force and Vivacity thro' every Stage of Life ; but never with more Efficacy than in Youth, when the Mind, be-

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ing unfurnished with Knowledge, seizes with a peculiar Eagerness on every Object that is presented to it, resigns itself to the Charms of Novelty, and easily contracts the Habit of Reflection and Attentiveness.

We might receive all the Benefit this happy Disposition is able to produce, did we employ it upon Objects equally fit to engage the Mind by Pleasure, and fill it with clear and instructive Ideas. Now this double Advantage is to be attained in full Perfection, by the Study of Nature; whether we consider her Disposition and Assemblage in general, or take a Survey of her Beauties in particular. Thro' all her Works she is qualified to please and instruct, because they are all full of Harmony and Contrivance. All the Bodies that surround us, the least as well as the largest, acquaint us with some Truth; they have all a Language in which they address themselves to us, and indeed to us alone. We learn something from their particular Structure. Their Determination to a certain End, points out the Intention of the Creator. The Relations they bear to one another, as well as to us, are so many distinct Voices that call for our Attention; and which, by the

Counsels

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Counsels they give us, replenish our Lives with Accommodations, our Minds with Truth, and our Hearts with Gratitude. In a word, we may say that Nature is the most learned and complete of all Books proper to cultivate our Reason, since she comprehends at once, the Objects of every Science, and never confines her Instructions to any particular Language or People.

It is from this Book lying open to every Eye, tho very little consulted, that we propose to give an Extract, with the View of making young Persons sensible what Treasures they possess unenjoyed, and to present to their Observation those things, that Distance, Minuteness, or Inattention may have concealed from them. Instead of passing methodically from general Maxims and universal Ideas to those that are more particular, we thought it incumbent on us to imitate the Order of Nature herself, and begin with the first Objects we perceive around us, and which are every Moment at hand; we mean Plants and Animals. We have begun with Animals of the smallest Bulk. From Insects, and from diminutive Creatures clothed with Shells, we proceed to Birds, terrestrial Animals, and Fishes. After

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an Examination of part of the Services they yield us, we pass to those we receive from Plants, with an Attempt thro' the Whole, to mix Profit with Variety. If we have not always confined ourselves to a scrupulous Regularity, it was because we think it allowable, in conducting the Mind to Truth, to expatiate out of the straitest Way when we find it too rugged; and to strike into the most agreeable and amusing Track, if it equally leads us to the Place we would arrive at.

But as it is not sufficient to give the Mind a Propensity to be curious, by entertaining it with agreeable Scenes, unless we likewise teach it to be moderate and cautious in its Curiosity; we have concluded this First Part with a short Consideration of the just Prerogatives, and necessary Limits of Human Reason, its great Interest consisting in the Enjoyment of whatever is accommodated to it, without vainly pursuing what it is not privileged to approach.

In these first Essays, and those that may follow, our Intention has been, not so much to collect all the deep Learning that might be advanced under each
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Particular, as to offer that which seems, in our Judgment, most easily to present itself to the first Efforts of Reason, and to be most adapted to the Taste and Occasions of those Readers we had principally in View.

We have comprehended all these different Points, not under the Title of, The Natural Philosophy of Children; which would have been very proper, had we only purposed to improve the most tender Age; nor under that of, General Physicks; which promises too much: Our Design not being to offer a System in favour of those who have made much greater Advances: But we have comprehended them under the Title of, NATURE DISPLAY'D; which only implies the exterior, or what strikes the Sense, and expresses with a sufficient Exactness, all of this kind that is granted to Mankind in general, which is intelligible to every Age, and which no one can avoid being acquainted with to a certain degree. We all enjoy Sight, and are conversant with the external Part of Nature. This View of it is for us, and, in confining ourselves to it, we, in every Part, sufficiently discover Beauty, Instruction and Truth. We are certain of

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the Existence of Objects; we see their Form, we experience their Goodness, we calculate their Number, we behold their Properties and Relations, their Tendencies and Use. Here is an ample Variety of instructive Exercise for the Mind. Every new Information is an additional Pleasure. We see our Riches increasing with our Discoveries, and the View of so many Benefactions must needs banish Ingratitude and Indifference from our Hearts. But if we desire to fathom the very Depths of Nature, to trace Effects up to their particular Causes, and comprehend the Curiosity and elastick Play of every secret Spring, as well as the minutest Elements that compose them, this is an arduous Attempt, and we leave it to those transcendent Genius's, who are permitted to behold and enter into those Mysteries. For our part, we think it better becomes us to content ourselves with the exterior Decoration of the World, and the Effect of those Machines which constitute the Prospect. Here we have Access, and may even see that it was arrayed with so much Splendor, to excite our Curiosity. But then, satisfied with a Survey that abundantly fills our Senses and Imagination, it is not necessary we should require the secret Pavilion of these Machines

Machines to be unfolded to our View. In a word, 'tis our Province to select out of the Scene of Nature all that can give us lively Impressions, and exercise our Reason to advantage, without ever touching upon those Points which seem above the Reach of that Faculty, or even upon those that would easily weary its Efforts.

As to the Model of the Work, we have endeavoured to exclude from it whatever might seem disagreeable; and instead of a methodical Discourse, or a Chain of Dissertations, that frequently satiate and disgust, we have chosen the Style of Dialogue as most natural and proper to engage all sorts of Readers.

Our first Thought in the Choice of Interlocutors, was to have introduced some celebrated Characters. It gives one a sensible Pleasure to see great Men revive in Dialogue, and by an agreeable Illusion we imagine ourselves Sharers in their Conversation, and are interested in what we believe we hear. But it is easy to observe how inconsistent such a Choice would have been with the Design we propose to pursue. If we had intended
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to establish Maxims for the Regulation of Behaviour, or to criticize the Imperfections of Mankind, we might with Success have borrowed from History a Set of Names that are well known, and proper to render the Discourse more important. These Personages would be as entertaining in Dialogue as they are in theatrical Representations, in proportion to the Conformity of their Characters and Sentiments to the Account we find of them in History. But the Case is not the same in Points of Investigation and Philosophy. 'Tis a very dangerous Attempt, to give Language to Des Cartes, Malbranche, or Newton, and to lend these great Men their Ideas and Views. 'Tis easy to declare, that we are going to introduce Gassendi and Rohault; that is to say, that we are going to revive their Understanding, Sentiments and Characters. But how can one be punctual to such a Promise? To think and speak like them, we must be what they themselves were. Besides, they are Persons that are not easily to be accommodated to the Level of all sorts of Readers. Their Conferences must be sublime and perpetual Dissertations, in order to preserve their due Similitude. Besides, we should gain no extraordinary Point, if we

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we brought together some of our most celebrated Observers; and, I am afraid, that Aldrovandus and Goëdaert, Malpighi and Grew, Leeuwenhoek and Swammerdam, would not be Personages proper to present to the Reader. As valuable as these Authors may be, their Names alone would not constitute the Success of a Dialogue; whereas Persons less conspicuous, will always make themselves known and relished, if what they advance is profitable and correspondent to Nature.

*After all, as our Intention is only to entertain the Minds of young People with a free Conversation, and such as is suited to their Abilities, without perplexing them with Characters too strongly marked out, or introducing a Vein of Pleasantry that would have too much the Air of the Theatre, we judged it proper without much Parade, and as it was also natural, to chuse the Country for a Scene of Dialogue on the History of Nature; and, in order to introduce or vary the Subject, to make use of Characters of different Conditions, some of whom might furnish out Conversation from their Knowledge and Experience, and others
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render it engaging by their Curiosity.

Besides this, there is a greater Advantage than at first may be imagined, in throwing the Sciences into the Discourse of polite People who are conversant with the World, such as Chance every Day assembles, and such as Friendship, or a Similitude of Taste selects. And tho these Personages give us at first less favourable Preventions than we receive from illustrious Names, yet, in the Event, we accommodate ourselves to them the better, because our Faculties need not make any extraordinary Efforts to understand and follow them. Whatever they say that appears curious and new, affects us with strong Impressions. We find ourselves touched with an agreeable Pride to hear such things from our Equals; and, whilst we give them our Attention, we fancy we are capable of thinking and amusing ourselves as rationally as they; and the secret Approbation we afford them, insensibly becomes a natural Allurement to imitate them. These are the Considerations that have regulated our Choice.

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A Youth of Quality, whom we shall call the Chevalier du BREUIL in the Vacation from his College-Studies, and at a time when his Father had taken a Journey to make an advantageous Provision for his eldest Son, pays a Visit in the Country to a Gentleman who was one of their intimate Friends, who employs, in the Study of Nature, the abundance of Leisure that the Peace afforded him.

The Count de JONVAL, for that is the Gentleman's Name, discovering an extraordinary Penetration and Vivacity in the Son of his Friend, endeavours to cultivate in his Mind the Rudiments of a good Taste, and a Philosophy that should every where prove advantageous to him. He associates into their Conversations the Prior-Curate of the Place, as a Man valuable for his Knowledge, and one whom a large Share of Piety and Politeness had rendered still more engaging. And as the Subjects of their Amusement were some of the most common Occurrences, the COUNTESS had an Inclination to increase the Company. All the Remarks that the young Gentleman bears made on Things that he had always

ways beheld with Inattention, are intirely new to him, and he never fails, at his return from Hunting or Fishing, with which the Day closes, to commit to Writing all he can remember of the Conversation; after which he gives his Journal to the Prior, for his Revisal and Correction. The Reader may suppose that this Journal of their Conference, so modelled and retouched, is what we now offer to the Publick.

If these Amusements or Studies, in vacant Hours, have the good Fortune to be pleasing to Youth, and especially to the Youth of our Nobility, who, as they are frequently in the Country, are more conversant with natural Curiosities; we may hereafter renew these Entertainments, and endeavour, to the utmost of our Ability, to substitute a Taste for amiable Nature and Truth, in the place of the false marvellous of Fable and Romance that now revives in an hundred new Forms, notwithstanding the Declension it was reduced to by the good Taste of the last Age.

What Labour soever we have been at to be informed, either by our own Diligence, or by Friends we could confide in, of

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most of the Remarks on Nature advanced in these Entertainments; we have still been careful to cite in the Margin of every DIALOGUE, the most celebrated Authors who have made the like Observations. We did not think it necessary to make use of what the Ancients have published upon some of these Matters, too often with more Credulity than Exactness; but the Reader will be more disposed to relish what he finds warranted by the Testimony of modern Observers, who have gained universal Reputation by their Accuracy and Circumspection.

The Works to which we have had chief Recourse for our own Information and to justify our Remarks, are the excellent History and Memoirs of the Academy of Sciences; the Philosophical Transactions of the Royal Society at London; the Tracts of Malpighi, Redi, Willoughby, Leeuwenhoek, Grew, Nieuwentit, Derham, &c.

The Alterations made in this second Edition are of two kinds. Some only relate to a few Expressions that seemed to be negligently touched. Others regard the Substance of things, which in some Places it

it was necessary to illustrate, or entirely reform. The essential Alterations shall be printed apart in a Supplement, and delivered with the Second Tome to those who have purchased the First Edition.



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INSECTS.



DIALOGUE I.

The Count de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Count.



SEE plainly, Sir, that if I don't take you by force out of my Closet, there will be no walking for us to Day. It grows late : Let us be gone.

Chevalier. Here's the *Prior* come very seasonably to make one of the Party.

B

Prior.

DIALOGUE I.

Prior. Gentlemen, I invite you to take the Air, and amuse yourselves in the Garden: we must turn the Chevalier out of this Closet, where I always find him. Would not one be apt to say, it was some Post given him to make good?

Chevalier. I am always uneasy to leave it: The Count has filled this and the two next Chambers with so many Curiosities, that one can never be tired here.

Count. Do you think so, Sir? No: *Paris*, from whence you came, is the Place where you must look for Objects to please your Eyes: Here you will meet with nothing but plain Nature.

Chev. She is a thousand Times more engaging than all the Glitter and Gildings of *Paris*. We are soon weary of seeing always the same thing. Here is a surprizing Variety: I believe, there is nothing brought from the four Quarters of the World, but what may be seen in this Place. The Count among other things must needs have collected Animals of every Species one can imagine. Some of them are of Nature's Creation, perfectly well dried and preserved, others are to be seen here in Picture at least. But nothing gives me more Pleasure than this Multitude of little Animals,

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nals, that are living; some of which are at work in the Window under a Glafs Hive; others spin or employ themselves after their manner in crystal Vessels. How delightful is it to live in the Country! Every Day it produces something new.

Count. Every Person has a particular way of thinking; the Army, and the busy Scenes of Life have taught me how to value Retirement; it pleases me, and has made me pass a great deal of my time very much to my Satisfaction; this Variety of Amusements makes it agreeable to me; but for Eyes like yours, full of the Grandeur of *Paris*, such Objects as Butterflies, Silk-Worms, ants, and Bees, must be very languishing Objects.

Chev. Since you have made me acquainted with the Use of magnifying Glasses, I have seen admirable things in insects. The single Head of a Fly is covered with Flowers and Diamonds; the Wing of a Gnat, which at the first View looks like a little white Rag, and seems destitute of all manner of beauty, appears, when you consider it attentively, as smooth as Ice itself, and flows like a Rainbow. I shall never be easy till I have examined all the rest with the same Exactness.

B 2

Count.

Count. You design then to be a Man of Singularity. But pray tell me, Sir, do you meet with any one that amuses himself with the Study of Insects? We commonly destroy them, at least they are not much regarded. If you intend to regulate your Pleasures by mine, you will chuse a very unfashionable Model. To enjoy rational Pleasures according to the gay Taste, a Man must be charmed with the Hurry of *Paris*, he should dress up to the Mode, fix his choice of a shining Equipage with a great deal of Attention, and not forget the Accomplishment of a peculiar Snuff-Box; the Morning must be employed in writing down the Article of a Collation, and when that important Affair is dispatched he must pass the rest of the Day in Visits, or Play; he must relish the magick Feats of an Opera, and the frolick Dexterities of *Harlequin* at a Fair. These are your polite People, and this is the Turn of Mind that has nothing in it to be reproached. But to spend three parts of the Year, like me, in the Country, and make the Study of the various Part of Nature one's Delight; to examine for Instance, the Structure of an Animal's Body, to trace a Plant from its Original thro' all its Progress, and

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form one's self by repeated Experiments of its particular Usefulness; I say, Sir, What do you think of this? Don't you find something very rustick in such a Life, and a great deal of the Cast of a dreaming Philosopher?

Chev. I conceive your meaning, Sir: you would give me to understand, that Men judge wrong; that they prize Trifles, and neglect what is fine and satisfactory.

Count. My dear Friend, since you enter into my Thoughts so justly, I will talk to you without reserve. The View of Nature enchants me, and I find new Pleasures in it every Day, even with respect to the minutest Objects. Let us not begin with surveying those immense Globes of Fire that roll above us, nor this Earth that unfolds so many Treasures to our View. Let us first consider the smallest Objects, we may afterwards ascend by degrees. The scene we behold is truly magnificent, but that which our View cannot take in at once, we may divide and enjoy by Parts.

The Design of the Work.

Let us begin with these Insects, so much despised, and which you are so fond of. I assure you they infinitely delight me by their Variety, their Dispositions, their Policy, and the wonderful

ful Proportion of their Organs, as well as a hundred Curiosities I observe in them. If the Deity did not think it unworthy of himself to create them, is it beneath us to consider them? but when we examine them in a nearer View, they afford us infinite Matter of Astonishment. Judge, Sir, by what is most obvious and familiar to our Observation, how much that which lies concealed from our Eyes and Reason, would surprize us, were it divested of its Veil.

The Definition and Division of Insects.

Every Insect, whether it flies or creeps, is a little Animal, composed either of several Rings which shrink from or approach one another in a common Membrane that collects them; or else of several distinct Scales that slide over one another; or, lastly, of two or three principal Parts connected by a Thread they call a Ligature.

Of the first sort are all Worms, as well those that have Feet, as those that are without them. When they would pass from one Place to another, they dilate the musculous Skin that separates the first Ring from the next. They advance the first Ring, whether it be near the Head or Tail, to a certain distance; and then, by contracting and expanding the Skin of that Part, they move

move the second Ring ; the same Effort draws the third, and so the whole Body moves in succession. In this manner those little Animals, even without Feet, march and transfer themselves where they please ; rise out of the Earth, and retire into it at the appearance of the least Danger, and advance and retreat as Need requires.

Of the second sort are Flies, and May-birds, besides an infinite Variety of others, whose Body is an Assemblage of many little Scales, which dilate by unfolding themselves, or contract by sliding over one another like Brassets or Cuisses, in our old Suits of Armour.

Chev. You have shewn me several of them in your Wardrobe.

Count. Of the third sort are Ants, spiders, and several others that you see divided into two or three Parts, which hardly appear to be connected with each other. It should seem that the Term *Insect*, given to all these Animals in general, is derived from a *La-* *Infecare, to cut.*
in Word that signifies *to cut*, and relates to these different Parts, Separations and moving Rings.

Their Minuteness seems, at first View, to justify the Contempt we entertain of them ; but, in reality, it gives us fresh reason to admire the Art and Mechanism

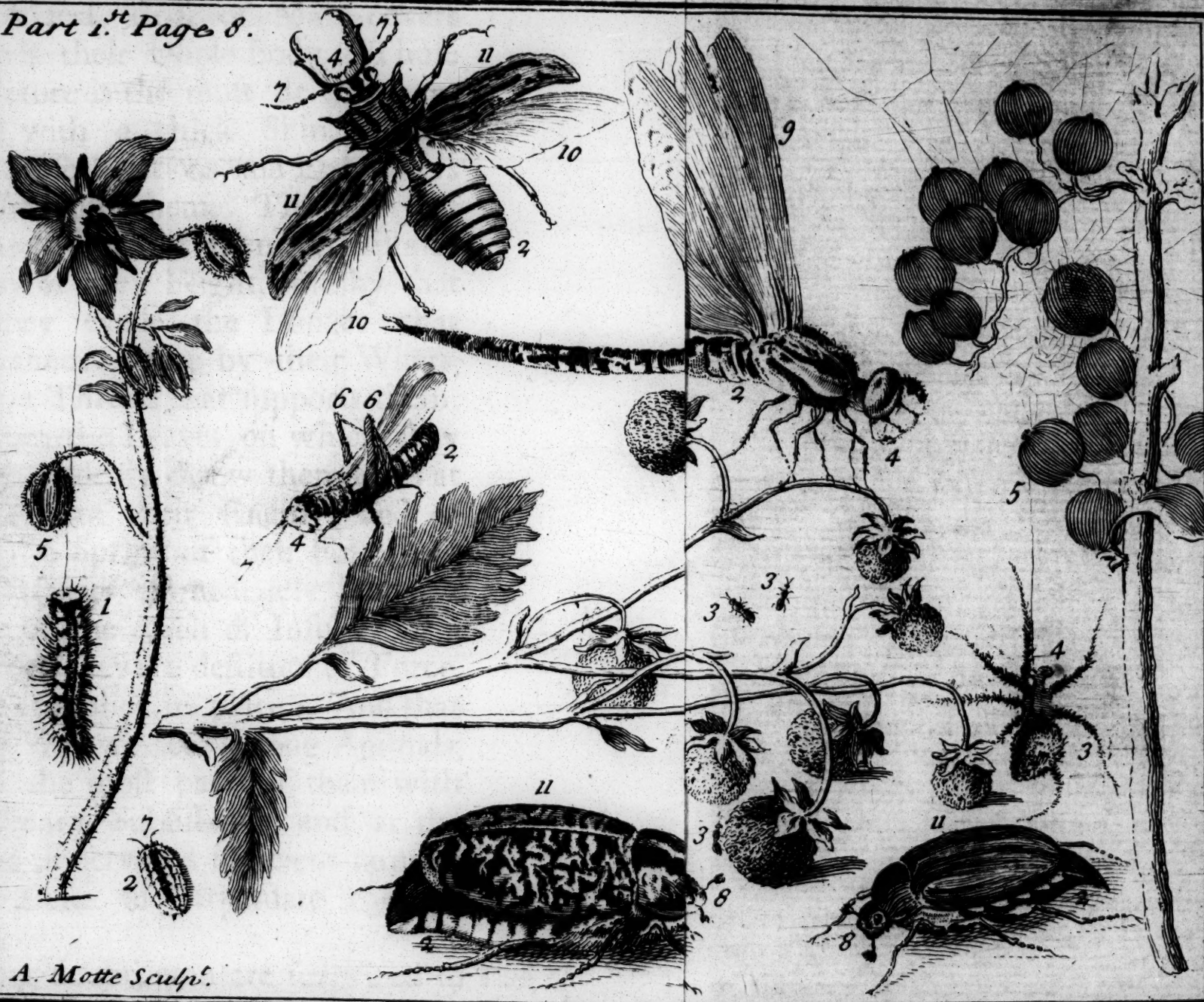
of their Structure, which associates so many Vessels, Fluids and Movements in a Point that is frequently imperceptible. Vulgar Prejudice considers them as the Effect of Chance, or the Refuse of Nature, whereas an attentive Eye discovers in them a Wisdom which far from neglecting them, has been particularly careful to clothe, arm and organize them.

Their
Clothing.

This Wisdom has clothed them, even to a degree of Complaisance, by laying out such a Profusion of Azure Green and Vermilion, Gold, Silver and Diamonds, Fringe and Plumage, upon their Robes, their Wings and the Ornament of their Heads. We need only behold a Glow-worm, a *Spanish Fly*, the Insect they call a Dragon-fly, nay a Caterpillar itself, to astonish us with this Magnificence.

Their
Arms of-
fensive and
defensive.

The same Sagacity that has been so liberal in their Ornaments, has completely armed and put them into a Condition of making War, and assaulting their Enemies, as well as defending themselves. If they don't always seize the Prey they watch for, or escape what is prejudicial to them, they are at least furnished with the most proper Abilities for succeeding in their Designs. The Generality of them are provided with

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- 1 The Assemblage of Rings in one and the same Skin. 2 The Scalesiding over one another. 3 The Ligaments of Ants, Spiders &c. 4 The Teeth or Saws. 5 Insects suspended by their Trad. 6 The Springs of the Grass-hopper. 7 The Horns or Antennæ. 8 The Horns or Antennæ in the form of a Comb. 9 the Wings of a Dragon Fly. 10 The Wings of a Beetle. 11 The Case of the Wings.



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with strong Teeth, or a double Saw, or a Sting with two Darts, or vigorous Claws. A scaly Coat of Mail covers and defends their whole Body. Those whose Nature is the most delicate, are defended with a thick Skin, which weakens those Frictions and Encounters that might injure them. The Safety of the greatest part of them, consists in the Agility of their Flight, and by that means they evade the Danger that threatens them: Some by their Wings, others by a Thread that supports them, when, from the Leaves on which they live, they suddenly throw themselves at a distance from their Enemy; and others by the Spring of their hind Feet, whose Elasticity immediately launches them out of the reach of Insult. In a word, when they are destitute of Force, Stratagem supplies its place: And that perpetual War we see among Animals, furnishes the most part of them with their ordinary Subsistence, and at the same time preserves a sufficient number of the Species to perpetuate the Individuals.

Without doubt, you are surprized to see Nature so careful in the Weapons and Attire of these Insects we despise; but your Surprise would be different, were you to take a particular Survey of the

Their Cr-
gans and
Imple-
ments.

the Organs she has given them for their Support, and the Implements each of them work with, according to their different Professions, for every one has his own. Some spin, and have a couple of Distaffs and Fingers to form their Thread ; others make Nets and Lawn, and for that purpose are provided with Shuttles and Clews of Thread. There are some that build in Wood, and are therefore supplied with Bills for cutting their Timber. Others make Wax, and have their Shops furnished with *Rakers*, Ladles and Trowels. Most of them have a Trunk, more wonderful for its various Uses than the Elephant's, and which to some serves as an Alembic, for the Distillation of a Syrup that Man could never imitate : To others it performs the Office of a Tongue ; many employ it as a Drill, to pierce with ; and almost all use it as a Reed, for Suction. Several of them whose Heads are fortified with a Trunk, carry in the other Extremity of their Bodies an Auger, which they lengthen, turn and contract at discretion ; and by that means dig commodious Habitations for their Families in the Heart of Fruits, under the Bark of Trees, in the Substance of Leaves or Gems, and frequently in the hardest Wood itself.

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There are few who have excellent Eyes, but have likewise the additional Benefit of a couple of Horns or Antennæ, that defend them, and which, as the Animal moves along, especially in the dark, make a Trial of the Way, and discover, by a quick and delicate Sensation, what would defile, drown or endanger them. If these Horns are moistened in any injurious Liquor, or bend by the Resistance of a solid Body, the Animal is warned of the Danger, and turns another way. Some of these Horns are composed of little Knots, like those on the Heads of Crayfish; others terminate in the Form of a Comb: a third sort are covered with little Plumes, or tufted with Velvet, in order to be preserved from Humidity. Besides these and many other Assurances, which vary according to the Species, most Insects have also the Gift of Flying: Some, as the Dragon-Fly, have four large Wings, which correspond to the Length of their Bodies; others, whose Wings are of that exquisite Fineness that the least Friction would tear them, have two long Scales which they raise and fall like two Wings, but which are no more than a Case for the real ones. You will find Beetles, *May* Birds and *Spanish* Flies, furnished with these Cases. You will

will also observe a great number who have only two Wings; but under these Wings you will perceive two Bladders, which are thought by some * to be a couple of Weights, or a kind of Counterpoise, by the Assistance of which the Insect supports itself against the Agitation of the Air, and continues in an Equilibrium, like a Rope-Dancer who poises himself with a Pole that has a weight of Lead at each Extremity; tho perhaps these hollow Vessels may be judged to be two Castanets, which the Insects strike with their Wings for their Diversion, or else to make themselves known to one another by the buzzing Sound.

I see, Sir, by your attentive Air, that we shall make you a Philosopher.

Chev. As you do me the Favour, Sir, to let me continue here for some time, I shall be Master of a Treasure at your Expence. With your Permission, I shall ask you a hundred Questions every Day. I am preparing to make the whole Class of Animals pass in Review before us. I shall be perpetually breaking in upon you, and don't intend to give you a Moment's rest, till I have robbed you of all your Knowledge.

* Derham, Theol. Phys. l. viii.

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Count. You may begin your Attack when you please; we shall endeavour to defend ourselves.

Chev. In the first place : I shall beg the Favour of you, when we have finished our Walk, or when it better suits you, to let me see in a Microscope these Habits, Arms and Implements of which you have told me such Wonders. According to you, Insects are as gaily dress'd as ourselves, and their Tools as neatly made as those of our best Mechanicks.

Prior. We may very well compare, as you do, Sir, the Instruments and Habits of Insects with our own; but then it must only be in order to discover the Inaccuracy of our Works, and the Richness, the Elegance and infinite Superiority that shine in those of Nature. Observe the Head of a common Fly in a magnifying Glass†. One can never be fatiated with seeing such a Profusion of Gold and Pearls on a Head so inconsiderable, and comparing it, with a secret Compassion, with some other Heads that affect the like Ornaments, without being able to imitate them. What has been said of the Lillies of the Field, is applicable to Glow-worms and many other Species: *Solomon, in all his*

† Explic. litt. de l'ouvr. de sex-jours.

Glory,

Glory, was not arrayed like the meanest among them. But we must return to what the *Chevalier* has already seen. Do you remember, Sir, what you observed at my House, when you obliged me with a Visit? You took my Microscope; What had I fixed in it?

Chev. On one side you had placed the Sting of a Bee, glewed upon a little piece of Paper, and on the other a small Needle, so very fine that one could scarce handle it.

Prior. How did the Sting appear to you?

Chev. It was most beautifully polished from End to End, and the Point was not to be discerned.

Prior. Observe one thing however, which I did not mention to you then. Pretty near the Point there is an Orifice, thro' which the Bee launches two little Darts of an inexpressible Fineness, and yet very strong and efficacious; so that what you saw, and what is commonly observed to come from the Body of the Bee, is not properly the Sting; but the Sheath, or a kind of Auger, to prepare an Orifice for the two Darts, in order to give them a deeper Penetration. But how did the little Needle appear?

Count.

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Count. It appeared to me all blunt and rugged, like a Bar of Iron out of a Smith's Forge.

Prior. The Comparifon is juft, Sir ; and indeed 'tis the fame in every thing elfe : In the Works of Man you fee nothing but Ruggednefs, Gaps and Inequalities, the Limits of his Induftry, and the Coarfenefs of the Instruments he uſes, are evident thro' the Whole ; every thing looks as if it had been made with an Ax or a Trowel, and diſcovers an unſkilful Artiſt, not at all acquainted with the Matter he works upon. On the contrary, the ſmalleſt Works of the Creator are perfect. In their interior Parts you will always find a Freedom, a Pliantnefs and Elafticity, whoſe Art, Structure and Correſpondence are known by him alone. In their Exterior, you will throughout the Whole conſtantly meet with the fineſt Touches of the Pencil, with Magnificence, Symmetry and amiable Graces.

Chev. I am determined to ſtudy all the Inſects that fall in my way. I will be acquainted with the whole Tribe.

Prior. Shew them no Quarter, eſpecially thoſe whoſe Colours are touched up with Luſtre. I pity every Butter-fly and Glow-worm that ſhall happen to

to fall in your way. However, as the *Chevalier* is so curious about Insects, 'tis easy to give him Satisfaction. Let us entertain him with an Account of the various Changes thro' which they pass, and their different Species: By this means he will collect those which please him most, range them in better Order, and grow acquainted with his whole Retinue.

The Origin of Insects. Their first State.

Count. With all my heart: Let us begin then with their Birth. Every Insect comes from an Egg, or else from a Seed that contains the Insect in Miniature, and which proceeds from two Animals. This Egg, which contains the Seed and first Nourishment, is the Product of a Male and Female Animal. The † Dam lays her Eggs very carefully in a Place she makes choice of, where she knows they will have Heat sufficient to hatch them, and where the Young, when they leave the Egg, will find all necessary Nourishment in the Places adjoining. In a word, Insects, like all other Animals, are first generated and then rear'd, which preserves the Species.

† There are some Species of Insects that seem possess'd of both Sexes at once, as Snails; so that they lay Eggs. But it is a constant Truth, that there can be no Fecundity without the Instrumentality of both Sexes.

Chevalier

Chev. You allow a Father and Mother then, to every Insect?

Count. That's a Point confirmed by so many Observations, that it may pass for a Maxim. But what puts it out of all Doubt is, that these little Animals are themselves Male or Female, lay Eggs, and become Founders of a numerous Posterity. Is it credible that Infants should be born by the way of Generation, and that their Parents should owe their Birth to some other Original.

Chev. It is not very probable — God at first created one Man and one Woman, from whom all the rest of Mankind are descended. He created one Lion and one Lioness, from whom all Animals of that Class proceeded; and every Insect has apparently multiplied its Species in the same manner.

Prior. But how shall we accommodate this regular Generation of Insects with the common Opinion, That they are engendered from Corruption?

Chev. I confess, Sir, this gives me some Difficulty; for you see, in effect, that all Matter in a State of Corruption perpetually breeds Worms.

Count. So they say: But do you believe, Sir, that when People express themselves in this manner they under-

C

stand

stand what they talk about? What is meant by the Corruption of a Body? 'Tis the Dissolution of its Parts. For Instance; Meat, Soops and Wine turn to Putrefaction, when the Air, especially a warm Air, penetrating those Provisions on all sides, dissipates their finest Parts, and leaves only those that are more gross, and less proper either to nourish or regale the Palate. 'Tis not to be conceived, that the inward Parts of a piece of Meat, after such a Dissipation, Change and Solution, are all at once better disposed to form an organized Body, furnished with Eyes, a Heart and Intestines; or, in a word, all the constituent Parts of a living Animal.

Chev. How, Sir, do you believe that a Worm, or a Caterpillar, has all you are speaking of?

Count. The least Worm, or the smallest Mite one can possibly discover in Cheese; the minutest of those Eels that are visible in Vinegar*, and the most diminutive Worm that plays so nimbly in other Liquors, have each of them the Parts I have mentioned. 'Tis an Animal that lives, that turns aside when interrupted in its way, seeks out its

* See the Tables of *Leeuwenhoek*, under the Word *Animacula*.

proper Food, eats and digests. It must needs have all that in little, which we possess in larger Dimensions; and I would as soon say, that Rocks and Woods engender Stags and Elephants, as affirm, that a piece of Cheese engenders Mites. Stags are born and live in Woods, and Mites in Cheese; but they both owe their Being to the same Original. Microscopes, and the Anatomy of Insects have demonstrated this Truth; and their uniform and regular Generation was formerly a Mystery, that at last has been sufficiently cleared up.

Prior. We must convince the Gentleman of this by some new Proofs. The common Opinion, That Insects rise from Corruption, is injurious to the Creator, and dishonourable to our own Reason. For if we bestow the least Attention on these minute Animals, that are formed with so much Symmetry and Art, and so wisely accommodated with all the Instruments they want, and who perpetuate themselves in a Form that never varies, we must either confess them to be the Production of Almighty Wisdom, or the Offspring of Chance, and the accidental Concourse of some Hours that have been changed and displaced. Now 'tis the last Absurdity to ascribe

ascribe Agency to Chance; nor is it at all better, to say Chance acts with any Design, Precaution or Uniformity. The same Wisdom, therefore, that appears so admirable in the Structure of an human Body, is as visible in the Composition of an Insect: And Corruption is no more the Parent of these, than it is of other Animals, or even Men themselves. Our next Business therefore is to enquire, whether Insects, wherever they appear, owe their Existence to a new and extraordinary Creation, or whether they are generated from a Seed with which God in the Beginning impregnated every Species, and wherein he has plan'd and deposited the Organ of future Animals, in Miniature; in order to their being disengaged and unfolded by time. This last Opinion seems most conformable to Reason and Experience, to the Omnipotence of God and to the sacred Writings; which inform us, that God, in the Beginning commanded every Plant to have Seed in itself of its own Resemblance, and every Animal to multiply according to its Species.

Chev. I begin to see that Things are as you represent them. We find it difficult however, to divest our Minds of the Notion that Insects are engendered

by Corruption ; for as soon as either Wood, or Meat begins to putrify, we see them swarm with Insects. What is it that produces them ?

Count. Nothing can be more natural, They are born in such Parcels of Matter, because other Insects have laid their Eggs there.

Chev. But then, Sir, they must be every where distributed, and all Places must be replenished with Eggs ; for otherwise, several things would putrify without producing Worms.

Prior. The Gentleman is embarrassed, because he sees Worms always appear where there is any Corruption. This inclines him to think that Eggs are lodged in every place, and only hatched where they meet with Juices proper to swell and nourish the Seed.

Chev. I have heard the *Count* say, that the little Seeds of Plants are carried by the Wind, and dispersed all about, and that at last they begin to sprout, when they meet with Juices convenient for them. May we not suppose too, that the Eggs of Insects are every where wafted up and down, and that ———

Count. Have not I told you that we should make you a Philosopher ? Your Father and Tutor will find you, at your

Return, a perfect Master of Physicks. And I am very glad, Sir, that you have fallen into such a Train of Reasoning. Several of the Ancients and Moderns have entertained the same Opinion: But don't attribute too much to it. For the Supposition, that the Eggs of Insects are dispersed in the same manner as the Seeds of Plants, tho it may seem so very specious, is not altogether exact. You yourself shall judge.

A Plant that bears Seeds is fixed in the Earth, and cannot transfer them to any other place; for this Reason, Nature, if I may use the Expression, has given Wings to these Seeds, to prevent their falling all in one place. Some burst their Shells with great Vigour, and scatter themselves over a large extent of Land; others are really furnished with little Wings, which convey them by the assistance of the Wind to a great distance; and others, besides this Advantage, have little Hooks that, in spite of the Wind, fix them to some particular Place. The Design of the Author of Nature could not have a more evident Display, and it appears no less in the disposition of Insect's Eggs; but then the manner is very different: for wherever you meet with any of these you will find them fastened by a Glue

so tenacious, that 'tis sometimes impossible to disengage them, without entirely breaking them; or else they are shut up in little Cells of different Forms, but all built with Art, and cautiously defended. From whence it appears, that Nature never intended these Eggs should be wafted up and down, but rather that they should be fixed in some certain Situation.

Chev. No more of my Comparifon: I give it up.

Count. I have not yet given you a fufficient Idea of the different Situation of the Seeds of Plants, and the Eggs of Insects: The former are entirely abandoned to the Wind; from whence we infer, they ought to be scattered up and down, tho they are not to take root wherever they fall; but in such Places only where they meet with Juices proportioned to the Smallness of their Pores. But it is quite otherwise with respect to the Eggs of Insects: They are unprovided with Wings, to transfer them to different Parts; but then their Parents can fly, and find out convenient Lodgments for them. And therefore if you always see Insects in a Body as soon as it begins to corrupt, it is not because these Animals are engendered by Putrefaction, or that the Eggs of In-

fects are every where scattered and distributed; but 'tis only because they have Mothers, who know that impaired and corrupted Bodies afford the properest Nourishment for their Young. They are attracted by the Odour, which exhales to a great Distance; nay, this very Odour was appointed to act upon them by such an Attraction. And in general, the Choice of the Parent to lay her Eggs in a Place that abounds with convenient Nourishment for her Young, preferably to any other Situation, is as proper as the original Disposition itself of those Young, to demonstrate, that Corruption cannot engender any Being, that Chance has no Agency. And lastly, that 'tis only Nature herself that prescribes to every Animal its Place, its Functions, and its Food.

Prior. If Chance does not any way interpose in placing the Eggs of Insects, it has still less to do in forming them.

Count. Nothing happens here by Chance. The Motions of minute Animals seem indeed accidental and capricious, but they as really tend to a certain Point as those of the largest Beings. We shall find all the Sagacity we admire in a Fox, for chusing himself an advantageous Kennel, and the same Industry with which we see a Bird make

make itself a convenient Nest, I say, we shall find all this actuating a little Fly, in her Choice of a commodious Mansion for her minute Posterity. No Insect abandons her Eggs to Chance, for the Parent never disregards them; and if the Young find immediate Nourishment when they forsake the Eggs, 'tis because the Mother has precisely chosen the properest Situation for their Support. Dissolve a Grain of Pepper in Water, and you will commonly see Worms of an incredible Smallness swimming in the Fluid. The Parent who knows such a Grain to be their proper Nourishment, never lays her Eggs in any other Place. Look at a Drop of Vinegar with a Microscope, where you will discover a number of little Eels, and never any other Animals; because one particular Creature knows that Vinegar, or the Matter that com- pounds it, is proper for her Family, and therefore deposits them either in that Matter, or the Liquor itself, and so where else. In those Countries where the Silk-Worm feeds at large in the Fields, her Eggs are only to be found on the Mulberry-Tree. 'Tis easy to see what Interest determines her to this Choice. You will never find upon Cabbage, any Eggs of the Caterpillar that

that eats the Willow, nor see upon Willow the Eggs of any Caterpillar that feeds upon Cabbage. The Moth seeks for Curtains, woollen Stuffs, dressed Skins, or even Paper, because its Materials are Fragments of Cloth which have lost the bitter Flavour of Hemp by the working of the Papermill. But you will never meet with this Creature either in a Plant, or Wood, or even in putrefied Meat. On the contrary, 'tis in this last, that the Fly deposits her Eggs. What Interest attracts her there would not her Eggs be better lodged in a fine *China* Vase, that she might always use as she pleased? — Experience will convince you better what is that regulates her Choice.

Take a Slice of Beef newly killed and put it into an open Pot; put likewise another Slice into a Pot that's very clean, and cover it immediately with a Piece of Silk, so that the Air may not transpire, and the Flies be prevented from sliding their Eggs thro' the Interstices. The first Piece will undergo the common Consequence; because the Flies have there full liberty to lay their Eggs. The other Piece will change and decay by the admission of the Air.

† See the Experiments of *Redi*, *Arezzo* and *Leeuwenhoek's* Anat. & Contempl. Arcan. Nat. Tom. I.

and at last be reduced to Powder by Evaporation; but neither Eggs, Worms or Flies will be found there: The most that can happen will be this, the Flies allured by the Odour, will settle in Swarms upon the Cover, and endeavour to enter; but at last will leave their Eggs upon the Silk, being unable to penetrate any farther.

Prior. This Instance makes it evident, that Corruption cannot engender any Animal, and indeed, several Insects seek what is quite different from it to lodge and nourish their Young. But if some Animals live in Putrefaction, this is no more surprizing to see them lay their Eggs in a Body tending to Corruption, than it is to see the Mother of a Family, and her Children, working with Sickles in a Field of ripe Corn. All Nature is full of Animals, some fixed to one kind of Nourishment, others to a different. All of them have their Eyes attentive on their Prey, and nothing eludes their Penetration.

Chev. I now begin to see more Order and Design in the Conduct of the least Animals, than I before imagined.

Prior. The more you come to Particulars; as amazing as the Variety of species, and their different manner of subsisting may appear, you will, thro' the

the whole, discover Traces of the same Wisdom that has inspired each Parent with a tender Solicitude for her Posterity, and worked, if I may so express myself by the same Plan, in referring every Species to the same Original ; I mean a Generation by Eggs, or the Seed lodged in them.

The Egg.

Count. Let us now see what an Egg contains. When the Female that produces it, has not had any Commerce with the Male, it is only replenished with a barren Nourishment, that soon dries and evaporates. 'Tis the Male that gives the Egg its Fecundity ; and then, besides the fine Aliment the Shell incloses, there is lodged in it a little Worm, whose exceeding Smallness renders it invisible, tho it has not escaped the Microscope of the celebrated † *Leeuwenhoek*, the greatest Observer of the last Age. This minute Animal, protected by the Shell that surrounds it, is gently nourished by the Fluid in which it swims. It increases in Bulk, and at length, perceiving its Habitation too contracted, breaks the Shell, and immediately finds itself accommodated by the wise Precaution of its Parents with a Food more strong and suitable to its new Condition.

† *Leeuwenhoek's Arcan. Nat. passim.*

Some, when they leave the Egg, have ^{Their second State,} their perfect Form, which they never lose as long as they live. Of this Kind are Snails, who quit the Egg with their House on their Back. They always preserve the same Shape and Habitation, only when they grow large, some few Circles are added to their Shells. Under the same Class we may rank Spiders *, who are perfectly formed when they come out of the Egg, and only change their Skin and Bulk. But the generality of other Insects pass thro' many Varieties of being, and assume the form of two or three Animals successively, who have no Resemblance to one another.

Chev. How Sir! Will a Caterpillar ever be any thing but a Caterpillar? and has a Bee ever been any Animal different from a Bee?

Count. Without doubt. There is an infinite Number of these little Animals that are composed of two or three Bodies very differently organized, the second of which unfolds itself after the first, and the third receives its Birth from the second. These are so many Metamorphoses. Have you never seen those of *Ovid*, Sir?

* Leeuwenhoek's Arcan. Nat. Tom. iii. Epist. 138.

Chev.

Chev. I am now reading them. I have gone thro' half, and am promising the rest. Those agreeable Fables divert me exceedingly; but after all, they are but Fables, unless they contain some hidden Meaning; and that is what I wish some body would discover to me.

Count. You are in the right, and should give no Quarter to those who lead you into their Explanation. In reading them, you must endeavour to unravel those ancient Histories that lie disguised under some of these Fictions, as well as those equivocal Expressions of the ancient Languages, that have given Birth to others. But since I find you as much a Friend to Truth as you are to the marvellous, I shall charge myself with the Care of all your Pleasures, and intend to bring you acquainted with a System of Metamorphoses altogether as extraordinary as those of your *Ovid*, and of whose Reality your Sight and Touch shall fully convince you.

Chev. That's the very thing I desire.

Count. What would be your surprise, should I tell you, there is a certain Country where a Multitude of Animals in different Forms, are to be met with, some of whom live deep in the Earth itself, others in the Water, and who afterwards assume a new Figure, live up-
on

On the Surface of the Ground, and
 creep like Serpents thro' Woods and
 fields; and then, after a certain Pe-
 riod, cease to eat, and build themselves
 habitations, or rather Monuments of
 death, where they continue buried
 several Weeks, and sometimes Months
 and whole Years without Motion or
 action, and to all Appearance, without
 life itself; and who, after all this, re-
 vive, and break thro' the Inclosure of
 their Sepulchres, unfold a most beauti-
 ful Plumage to the Sun Beams; and
 with expanded Wings commence Inha-
 bitants of the Air?

Chev. I should be glad to know
 where this Country lies, and what are
 the Names of those Birds. But I find
 very difficult to believe, that —

Count. Nothing in Nature is more
 certain. The Country I am speaking
 of is our own, and these Animals are
 the Insects that are daily presenting
 themselves to our View.

Chev. How! are we talking of Flies,
 Caterpillars, Wasps and Bees?

Count. The very same.

Chev. Pray what Change do they un-
 dergo?

Count. These and many other Insects,
 when they come out of the Egg, are
 no more than little Worms; some with-
 out,

Their intermediate State.

out, and others with Feet. Those who have none are left to the care of their Parents, who take upon them the Charge of lodging their Offspring in commodious Habitations, and furnishing them with their necessary Aliment, or they even place them in the Center of the Substance that is to sustain them. Those who have Feet, look out for Nourishment themselves, on the Leaves of a Tree most suitable to them, and which proves to be the very same on which their Mothers have placed them. In a little time they increase very sensibly in Bulk. Many of them cast off their Attire, and assume a new Youth in a Skin they change five or six times. After this, all of them (remember I am speaking of those who undergo any Change) pass thro' an intermediate State called either the *Nymph*, or *Chrysalis*, the *Shell*, or *Bean*. These are different Terms, that signify very near the same thing, and which 'tis necessary to give you an Explanation of. The little Worm in process of time ceases to feed, and incloses itself in a kind of small Sepulchre, that varies according to the Nature of the Animal, but is built by each Species in an uniform manner. And there, under a Foldage that preserves the great Delicacy of its Texture from all

all Injury, it acquires a new Conception, and a second Birth. 'Tis then called a *Nymph*, which signifys a young Bride, because the Insect in that Period puts on its beautiful Attire, and assumes the last Form, in which it is to multiply its Species by Generation. This Form is called the *Chrysalis*, or the *Aurelia*, or Golden Nymph, because the little Film, whether hard or tender, with which it is invested, is by degrees tinged with a very bright and glowing Colour. It likewise goes by the Name of the *Shell*, or *Bean*, because 'tis then wrap'd up in a Skin generally very hard, and like the Shell of an Egg, or the Coat of a Bean. But it must be granted, that the Term *Shell* is most commonly used to signify those little Balls of Thread and Glew, in which Silk-Worms, and some Caterpillars wrap themselves when they become Nymphs.

In a word: Their fourth and last Their last State. state, the great and final Metamorphosis which happens to them, is when they rise out of their Tombs, and become flying Insects; they then break thro' the Inclosure that surrounds them, and the Plumes that adorn their Heads begin to appear; they unfold their Wings, and —. But let us defer the Wonders of their Resurrection till To-mor-

D

row,

row. We must allow our good Friend, the Chevalier, a little time for Hunting.

Chev. No, Sir : Go on I beseech you. Some of these *Aurelias*, in which Caterpillars intomb themselves, have been often shewn me in the Form of Infants in Swadling-Clothes ; but I thought they had been dead, and nobody undeceived me. You will give me a particular Pleasure in acquainting me how this Change is accomplished.

Count. To-morrow we will enter upon the Particulars. In the mean time, I am not a little pleased to find you relish our Metamorphoses ; but I would willingly give them a new Merit.

Chev. What may that be, Sir ?

Count. To make them desirable, let us reserve them for another Conversation. I know you are uneasy at this Delay, and believe me, Sir, I am charmed at your Impatience. There are very few of your Age, who would not be pleased at the Conclusion of such a Discourse as this.

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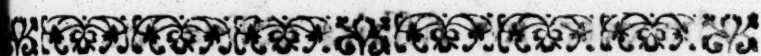
The End of the First DIALOGUE.



CATER



CATERPILLARS.



DIALOGUE II.

The Count de JONVAL.

The Countess de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Count.



Don't see any body here.
My Lady's Company
is all withdrawn. Let
us place ourselves in
this Arbour, and con-

inue our Subject of Insects.

Prior. The Chevalier has been read-
ing to me this Morning, a Summary of
our Yesterday's Conversation, which
will please you exceedingly. He fully
demonstrates, that Corruption would be
possessed both of Wisdom and Power,

were it capable of forming an organized Body ; he succeeds as well in the Reasons he assigns for the Parents Choice of those different Places where we find the Eggs ; and has been as accurate in his Account of the various Changes the Generality of Insects undergo.

Count. We must appoint the Chevalier our Secretary. I am persuaded I shall find my Advantage in it ; for whenever my Affairs oblige me to be absent, I shall know by his means all the Particulars of your Conferences.

Prior. Believe me, Chevalier, since you have already acquired a Habit of Thinking, and can express the Thoughts of others with such a Grace and Perspicuity, you have gained a noble Point and we intend to make you the *Fontaine* of our Academy.

Count. Where did we break off Yesterday ?

Chev. We were upon Insects which change their Form, and you had traced them up to that State you call the *Nymph*, or Shell ; from whence, by a new kind of Resurrection, or Metamorphosis, you converted them into another Set of living Animals. And now I should be glad to know if they really die before this Alteration.

Prior

Prior. Some Naturalists think not ; because Worms, Caterpillars, and other Insects, according to them, are no more than a sort of Case that for a little time encloses the Butterfly, or other winged animal, that is to rise out of it *. They add ; that if you throw a Caterpillar into warm Water, you easily divest it of its different Skins : Nay, they even imagine they discover the minute limbs of the Butterfly that is to disengage itself from that Covering.

Count. May we not venture to affirm, that the Insect, in the Progress of its conversion into a Nymph, actually dies ? 'Tis a real Animal, furnished with Eyes and Feet, a Body and Instincts ; in a word, with all the Members proper for it ; and which is entirely different from the flying animal that is to succeed it. It afterwards divests itself of its Head, its Eyes and Body, and is then in an evident State of Death. Take away the Head and Body from any other Animal, and you deprive it of every thing. The destruction of the Parts, implies that of the Whole. Thus the Lion, the Horse, and all other Creatures, cease to live. But as for the Worm,

* History of Insects, by Swamm.

the Caterpillar, and a variety of other little Animals that are thought so despicable, their Death is the Original of a new Existence; their End is the Commencement of another Order of Things. When a Worm is dead it produces a Fly; a Butterfly rises from a Caterpillar; and Insects that fly proceed from those that creep. 'Tis true, there remains of the preceding Animal, a living Embrio, or shapeless Being, replenished with a Fluid that gradually contributes to its Perfection. 'Tis also granted, that 'tis possible to discern the last Animal under the Skin of its Predecessor in which it lay involved. But still the first is a real Animal, that dies to make room for the second.

Prior. We must observe however that the first Animal is not a Stranger to the second, but regards it as part of itself, or rather, a second Self, wherein it shall enjoy a Repovation. The indefatigable Care with which it builds a Repository for the Spoils of the old Insect, sufficiently intimates its Expectation of something better, and more exalted. 'Tis not at all intimidated by this Appearance of Death, which is more than its Passage to a more amiable State; and far from being dismayed at the View of its Winding-Sheet,

perfect

persists with Assiduity and Joy, in preparing it, and exhausts all its Strength and Substance to complete it.

Count. I can't see any thing so proper to clear up this Point as the Thread, the Cone or Shell, and the different Labours of Caterpillars and Silk-Worms. Let us begin with Caterpillars ; we will afterwards proceed to other Animals.

Chev. I have been a long time desirous of knowing the manner in which they spin, and the particular Form of their Distaff. Caterpillars.

Count. I think I see one there, listening to our Discourse.

Chev. I protest 'tis the Countess herself behind the Arbour : Let us go and receive her.

Countess. Gentlemen Academics, my company have all taken their Leave of me. I saw you go into the Arbour, and came softly to the other side : I assisted at the Opening of your Conference, and over-heard all that passed, and since the Discourse turns upon Thread and Distaff, you'll permit me to take my Seat among you. I think I have some Privilege to speak upon the Subject of Spinning, and can find the Secretary some Employment.

Chev. The more you are pleased to employ him, Madam, the oftner you'll make him conversant with Wit.

Countess. I am obliged to you for such a favourable Reception. Well, your Compliments are paid; let us return to your Subject.

Count. We were talking of Caterpillars, whose different Species, that are already known, amount to more than three hundred †; and every Day new ones are discovered. One Species entirely varies from another in Shape, Colour, Inclinations, and manner of Life: But in the same Species every thing is perfectly uniform. Let us first examine what they all have in common.

Rings. They are all composed of several Rings like Silk-Worms; and as they enlarge and contract the Distance between them they move their Bodies wherever they have occasion to transfer them.

Feet. They have a certain number of Feet that bend and play, by the means of little Joints; and are armed with Claws, to fix and rivet themselves to the Bark of Trees, especially while they sleep.

Thread. Almost all of them have a Thread, whose Substance is a liquid Gum; which they extract from the Leaves they eat.

† See *Godart's general History of Insects*, *Aubriet's Collection*.





A. A. Caterpillar of Surinam. See the figure 17. The Chrysalis of this Caterpillar. C. the Butterfly of the same Collection. E. the Antennæ or Horns of the same.



Collection of Madam Maria Sibylla Marian. B.
 rung from the Chrysalis. D. Another Animal of
 the Trunk for Suction.



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When they are apprehensive of being carried away by any Bird, or crushed by the moving Branches, they shed a few small Drops of this Gum upon the Tree ; and then, precipitating themselves, spin it in their Descent thro' several Orifices of their Bodies, which furnish as many different Threads, that they bring together with their Claws ; and as the Threads are moistened with a natural Glew that unites them by a strong Cohesion, they by this means form one entire Thread, capable of sustaining the Animal's Body in the Air †.

Countess. Methinks I see one of our Ropemakers, who, after he has fastened the End of his Work to the Wheel, retires from it backwards ; and continually throws out several Twists of Hemp, which he mixes together, and joins with his Fingers ; and out of them all makes but a single Rope.

Prior. The Comparison is very just : The only little Difference I can observe in it, is, that the circular Motion, which is perpetually communicated by the Wheel to all the Rope, is that which joins several Threads into one under the Fingers of the Ropemaker ;

† Leeuwenhoek, Arcan. Nat. Tom. iii.

whereas,

whereas, in the Instance before us, a certain Glew that, with the Assistance of the Caterpillar's Claws, unites the several Threads.

Count. What surprizes me most, is that a Fluid which seems, when the Caterpillar is crushed, to be as thin as any other Liquor, or, which, at least, resembles a very soft and diluted Glew should thicken into a Consistence, and grow dry and tenacious, the Moment the Creature goes to work with it; in short, that it should immediately be useful to her as a strong Chain, to keep her suspended out of the reach of danger, and should afterwards assist her like a Ladder, to ascend to her former Situation.

Hair.

This is not the only Assistance Nature has granted to her extreme Imbecillity; for she is generally covered with Hair, that preserves her from the rude Access of Waters, in which she would otherwise be drowned or frozen. The same Hair warns her to slide down from her Station before the Branches, agitated by the Wind can crush her; and when the Thread by which she hangs is disconcerted or broken, the Hair, with which she is thick set, prevents her from being bruised in her Fall.

Would

Would you believe, Chevalier, that Colours.
 en the Colour of Caterpillars is one
 the best Preservatives many of them
 joy against the Birds, who can find
 Sufenance so delicate and pro-
 er for their Young, as these Crea-
 res.

Chev. Does your Lordship mean those
 little shining Specks with which their
 backs are spangled?

Count. No: These Specks rather con-
 tribute to distinguish them, especially
 when they are seen near. What I mean,
 is, that almost all of them have one
 principal Colour, which perfectly re-
 sembles that of the Leaves they feed on,
 or the little Branches where they fix
 themselves when they cast their Skins.
 The Caterpillars that eat Buckthorn are
 exactly of the same Colour. Those who
 are nourished with Cabbage Leaves are
 of a fine pale Green, like a Cabbage.
 Those who confine themselves to the
 Apple-Tree, or Bush, are more em-
 brown'd, and of a Colour which ge-
 nerally resembles that of the Wood.
 You'll see the last of these quit the
 leaves, and prudently retire along the
 Branches, when the time for casting
 their Skins is come. By these means
 they are confounded with that which
 supports them, are less visible, and du-
 ring

ring their long sleep escape the Birds who are searching after them.

Chev. But to what Purpose then has Nature furnished Birds with a Bill to seize their Prey, if that Prey has a hundred Conveniences for escaping?

Countess. Does not the *Prior* find Contradiction in this?

Prior. 'Tis true, Madam, a seeming Contradiction appears, and indeed reigns thro' all Nature; but in Reality, 'tis the Effect of a Sagacity that is no less evident. This pretended Contradiction keeps all Nature in Exercise and Action. All Animals are either employ'd in Invasions or Defense, and Nature has given Arms offensive and defensive, to each Individual. By these means the all find Animals enough to sustain one another, and yet there is a sufficient Number preserved to perpetuate the Species. Each Family is sustained, and every Table furnished to this Moment, and yet there is a large Overplus of Provisions for many Days. Is there not a kind of Contradiction in permitting Fishermen to catch Fish, and at the same time obliging them to use Nets with large Meshes, thro' which not only the Fry, but even Fish of a pretty good Size escape? And yet this is no more than a just Precaution taken by

life Government, that at once provides for present Necessity and future Want. Nature has accommodated all Animals with Nets, and permitted them to fish and sustain themselves; but then she has prudently limited the Dimensions of the Meshes. Vast Quantities of Fish are daily caught, but there are always more preserved than taken, whether they escape thro' the Meshes, or else happen not to be invaded.

Countess. Chevalier, we are not the worst Managers of a Contradiction: When you start a Hare, and she flies before your Dog, do you find any Contradiction there?

Chev. None at all. On the contrary, nothing is more natural or better designed. If Hares did not defend themselves, our Dogs would have nothing to

Count. What you observe in the Hare and Dog, you may pronounce of other Animals, and even Insects themselves. Nature inabling some to attack and seize, has not left the others defenseless: The least have their Preservatives. You see that even such feeble Insects as Caterpillars, are not unprovided with the means of their Preservation; and to these they add their little Policies and wise Precautions. For Instance; you will

will oftner find them under, than upon the Leaves they eat ; the Reason is, that they may not be discovered by the Birds. Oftentimes they do that before a Bird, which a Mouse practises before a Cat: they counterfeit Death, and so amuse their Enemy. And when, by this Stratagem, they have made him negligent, they improve the favourable Moment, and conceal themselves. I have seen * others extended in a motionless Posture, and counterfeiting Sleep; upon which a number of little winged Vermin, that were flying about at a small distance, have immediately fastened upon them, as a sure Prey. The Caterpillars, for some time, let them run over their Backs, and then suddenly turning their Heads, they have seized their Enemies, and regaled themselves with their Flesh.

Chev. How, Sir ! Are they Flesh Eaters too ?

Their
Food.

Count. I believe † this Species of Worm is not so much to accommodate them with Food, as to deliver them from a disagreeable Enemy : Their common Sustenance is the Leaf of some particular Plant ; and each Species is com-

* Godart.

† *Monf. de Reamur* thinks this pretended Caterpillar that seizes the little Vermin, is a carnivorous Worm.

ended to be satisfy'd with one certain
ant: and they pay such a strict Obedi-
ce to that Injunction, that they will
ner die with hunger than touch any
er Leaf, unless they meet with one
ose Qualities correspond with those
their ordinary Food. However, we
st except from this Rule some par-
ular Species who are less precise in
s Point, and can accommodate them-
ves to any thing.

Chev. Is there not some Inconveni-
ce, Sir, in this Regulation? Suppose
Plant assigned to one certain Species,
Caterpillars should happen to fail,
at Class of Insects would be extinct
o. Why should they be confined to
ch narrow Bounds?

Countess. You criticise upon Nature,
here you certainly ought to thank
r. If our Apple-Trees, that at pre-
nt have only a few Species of Cater-
llars for their Enemies, were given up
the Ravages of two or three hundred,
dge how our Desarts would suffer.

Chev. I am now convinced that it was ^{Their} wisely ordained, that Caterpillars should ^{Use.}
ly be destructive within certain Bounds,
d I had no Reason for my Complaint,
nce we find our Advantage in this Li-
itation. I should rather have asked,
hy some Species multiply to such a
degree

degree sometimes, as to carry Destruction with them wherever they go? It is not many Years since that Species of them which love the Apple-Tree, did not spare so much as one Leaf. Those Trees were all loaded with Fruit, which immediately withered away and perished. What may the Use of Caterpillars be in general? In my Opinion we might do very well without them.

Pfalm
cxlvi. 9.

Prior. They are very far from being useless: Destroy Caterpillars and Worms and you starve the Birds; for those that we eat, as well as those that entertain us with their Songs, have no other Substance in their Infancy. 'Tis then that they address their Cries to the great Creator, and he multiplies Food for them, accommodated to the exceeding delicacy of their Texture. In a word 'Tis for them that he every where destroys Worms and Caterpillars.

Their Duration.

Count. The little Birds, in reality don't forsake their Eggs till the Fields are replenished with Caterpillars; and these disappear when the Young, grown stronger, have Occasion for another sort of Nourishment, or can live without the Food they were first accustomed to. Before the Month of *April* there are no Caterpillars, nor Broods. In the Month of *July* there are neither Broods, nor

Caterpillars.

Caterpillars ; the Earth is then covered with Grain, and other Provisions of every Kind.

Prior. Till that time the Birds have Caterpillars assigned them for their Support ; and 'tis but just that these should likewise be furnished with proper Food, and this they are supplied with from the Plants. They have a Right as well as ourselves, to the Verdure of the Earth: They have a certain Title, Gen. i. 29, 30. founded in the Permission God originally gave to every Creature that lives and creeps upon the Earth, of receiving its Nourishment from the Plants ; and their Charter is as authentick as ours, since it is precisely the very same.

The Participation of the Herbs and Fruits of the Earth which Insects are permitted to enjoy in common with Man, is frequently very prejudicial to him ; and, as such, was both foreseen and ordained. Man wants to be instructed, as well as sustained. His Ingratitude is confounded, when these Insects deprive him of what God had display'd to his View with so much Liberality ; and his Pride is no less humbled, when the Lord commands his attending Armies to march forth, and, instead of Lions and Tygers, or other

E for-

formidable Animals, sets Caterpillars, Flies and Locusts, in array against him. Such inconsiderable Instruments as Worms and Flies, are employed by the Almighty to give a Lesson of Humility to Men, who are too apt to flatter themselves that they are rich, and great, and independent. You see, my dear *Chevalier*, that the same Hand which created the Fly and the Caterpillar, has also formed the Lion and Tyger. He has prepared a convenient Nourishment for them all, because he knows the particular Uses for which he has reserved them. Every thing that he has made is good in its Season; and when our weak Apprehensions cannot penetrate into the Motives of his Works should we, for that Reason, presume to diminish from them, or wish any Addition to them? But you will tell me I am preaching, and therefore we will proceed to some other Matter; and beg the Favour of the *Count* to give us a View of Caterpillars, as they are employ'd in building their Tombs.

Ecclef. iii.
2.

Countess. I find you don't expect much from me, and so I am not asked any Questions. However, I would willingly be of some Consequence in my Turn and desire Leave to send my Servant up to my Closet, for a little Box that will

spea

Of INSECTS.

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peak for me as well as a fine Harangue, were I capable of making one. You will find in it what will entertain your Eyes at least. In the mean time, let us take a View of the Caterpillar's Funeral.

Their
Tombs.

Count. Towards the end of Summer, and sometimes sooner, the Caterpillars, when they are satiated with Vegeture, and have changed their Skin several times, cease to eat, and employ themselves in building a Retreat, where they are to quit the Life and Form of a Caterpillar, and undergo a Transformation into a Butterfly. It should seem as if they fore-knew exactly, how long they were to be inclosed in their Shells or Nymphs, because in proportion to this Duration they give their Buildings more or less Solidity. Those who are to remain but a few Days in this Condition, chuse a tender Leaf, and make it still more supple by moistning it with a certain Glew. This Leaf by degrees shrinks and grows dry, and then folds itself about the Animal, whose Form it likewise assumes, and at the same time shelters it from all Injury, till the Warmth and its own Wings enable it to break out of its Confinement, and expatiate in the Air. Others, who are to be changed into Butterflies in as little time as those we

last mentioned, content themselves with fastening their Tail to a Tree, or sheathing it in the first Hole they meet with, under a Beam, or in some Plant; or else they keep themselves suspended by a Thread, or a Drop of Glee fasten'd to the Prop of a Vine, and continue in this Condition with their Heads hanging downwards. They are covered with a kind of Sweat, that thickens and dries in the Form of a Shell around them; and for some time they appear in this manner like a shapeless Embryo, where all the Parts of the future Animal seem confounded in a Paste that without doubt contributes to their Formation. At length this Embryo, or *Chrysalis*, after it has undergone a State of Fermentation, disengages its Legs and Wings, that were before invisible and embarrassed under the Foldage, then becomes a Butterfly; springs from its Confinement, and flies to the Fields.

Those who foresee they are to pass several Months, and especially the Winter, in their State of *Nymphs*, take very different Precautions. The most part cover themselves with Sweat by the Agitation of their Bodies; after which they roll themselves over Sand and are incrusted in the Grains that are collected by the fluid Glee which sur-

round

ounds them. You see they build in stone, and arch a Vault, under which they patiently expect their last Transformation.

There are others who build in Wood, and scoop out a sort of Coffin. Those who lived upon the Leaves of the Willow, crumble the Wood of that Tree into small parts ; these they afterwards reduce to Powder, which they moisten with the natural Glew or Sweat that distills from them, and then knead it into Paste : After which they roll themselves up in it, in such a manner that this Paste, as it dries about them, assumes the Form of a little Mummy, and looks like the Mould of the future animal. I have some of them in my Leg-pocket, and the *Chevalier* will be pleased at the Sight.

Chev. They are really pleasant Figures ; nothing can look more like * Insects in Swadling-Clothes. Here is one that has two Eyes and a very Aquiline Nose, and a little lower a couple of cheeks finely rounded ; the Turn of the whole Face is very regular. There is another that has an Old Man's Beard joined to an Infant's Face. This wears an Imperial Crown, but that Crown covers a Death's-Head.

* Godart.

Prior. The Imagination helps one a little.

Cher. Is it possible, Sir, there should be any Life within; and is a Butterfly to spring out of this Ruin? Every thing seems quite dead.

Count. If you press them a little, you will find some Signs of Life, I could not give you a better Idea of their State of *Aurelias* or *Nymphs*, than by letting you see these little Tombs out of which as many Butterflies are to rise. Those that are Females will lay their Eggs either upon the very Plant that formerly nourished them, or upon one of the same sort. They range their Eggs sometimes in a strait, or else in a circular Line: sometimes they wind them in a spiral Line round a little Branch, and always fasten them with such a binding Glew that the heaviest Rains can't wash them away.

You find some Caterpillars who, in their Works, neither imitate the Mason or Carpenter; but artificially spin themselves a warm Robe for the Winter. We shall give you a clearer Conception of this curious Work, when we come to describe the Cones of Silk Worms to which they bear a perfect Resemblance.

The Caterpillars we are most acquainted with are found in great Numbers upon Elms, Apple-Trees and Bushes. The Butterfly that proceeds from these, chooses some beautiful Leaf, on which she fixes her Eggs in Autumn, and soon after dies, glewed and extended upon her beloved Family. The Sun, whose Rays have still some Power, warms her Eggs, out of which, before the Winter season, a multitude of little Caterpillars spring, who without having ever seen their Mother, and without the least Model or Instructions, immediately, with a kind of Emulation, betake themselves to Spinning, and with their Threads industriously weave themselves Beds, and a spacious Habitation; where they shelter themselves from the Severity of the Season, distributed into different Apartments, without eating, and frequently without stirring abroad. There is only one little Opening at the bottom of this Mansion, thro' which the Family sometimes take the Air towards Noon, in a fine Sunshine, and when the Weather is settled. When you would open their Retreat, you must employ a little Strength to break the Tissue that forms it, which is generally as firm as Parchment, and not to be penetrated by Rain, Wind or

Cold. There you find the whole Family reposing on a soft and thick Down and surrounded with several Folds of the Web they have spun, and which once supplies them with their Quilts, their Curtains, and their Tent.

Chev. 'Tis extremely surprizing to see such tender Animals pass the Winter in this manner; but it amazes me yet more, that they should live all that Season without Eating.

Count. There are various Species of Birds, Reptiles and Insects, that sleep several Months in this manner; and they suffer no Dissipation of their animal Spirits, so they want no Recruitment from Food. All these sleeping Caterpillars awake in the Spring, and the first Bud they meet with excites their Appetite. In the Day they leave their Habitation, and always return to it at the approach of Night, or bad Weather.

But of all the numerous Classes of these Animals †, there are none so wonderful as those who undergo a double Moulting (if I may so call it) and are transformed into Butterflies, and sometimes seem to be changed into small Flies. If you believe the common Opinion

† *Godart's History of Insects.*

on, this Species is to be found upon
lly-Flowers and Coleworts. When
ey improve their Time, and are
anged in the usual manner into *Au-*
ias, they produce Butterflies; but if
ey let the proper Season for that
ransformation slip, they sometimes
e to the next Year, and then change
eir Colour, and assume a whitish
ue; but, instead of passing thro' the
etamorphosis that happens to others,
have sometimes seen forty or fifty
tle Worms issue from the Body of
e Caterpillar, after they have pierced
r Skin in different Places, to facilitate
eir Passage. When they have thus
sengaged themselves, each little Worm
gins to spin itself a Covering of yel-
w Silk, beginning at the lower part of
Body, and rounding the Work up-
ards, till it terminates in a Point on
e Head. As soon as the young Off-
ring have, by their own Labour, shut
emselves up in this Inclosure †, the
arent Caterpillar, in her Turn, wraps
o her pretended Family in a Silk she
ins all round them; and survives this
peration but a short time. As to the

† *Godart* ascribes this Work to the Parent Cater-
lar; but she seems at that Period to be incapable
Spinning. The little Worms themselves spin this
mmon Inclosure, and their particular Covering.
Reamur is of this Opinion.

Birth

Birth of these Worms, I am persuaded it must be violent and irregular; and whether it be that the Caterpillar in feeding upon a Plant, happens to swallow the Eggs of Flies, that are lodged upon the Leaves, or rather, that some particular Fly, perceiving the Caterpillar in the declension of its Age, and hastening to its End, digs little Cavities in the Body of the Creature and there deposits its Eggs: 'Tis certain that all these minute Worms, without discovering any other Conforming of Nature or Inclination to a Caterpillar, than the Thread that surrounds them, are at last changed into so many little Flies; which we cannot, with any propriety of Thought, call the Offspring of that Caterpillar.

The Caterpillar, known by the Name of the *Devourer* *, and who sustains itself with the Leaves of the Elm, produces sometimes, by the same Process of Generation, a very vigorous Fly that has Courage enough to give Battle to the Garden Spider. I wish I had the two Champions here to entertain the *Cher valier*. At the first Encounter, the Fly darts with all its force upon his Enemy who lies in Ambush in the Center of

* Godart, Exper, liii.

Web. The Spider immediately falls from his Situation as stunned with the shock; but, in his descent, always spins his way down. The Fly takes Advantage of his Adversary's Disorder, springs upon his Body, and after he has dragged him to the Earth, breaks all his legs; he then wheels very fiercely round the Spider, either to seize him in some part where he can have no apprehension of his Claws, or else to justify his Joy at his Victory over the enemy of his Species: And after he has thus marched round him two or three times, he fastens upon him, and immediately flies into the Air with his captive.

Chev. This Creature is the very *Achilles* of the Flies: And it was exactly in this manner that *Achilles* treated the unfortunate *Hector*; for after he had overthrown him in the Dust, he disarmed him, and when he had offered him a thousand Insults, dragged him to his Tent.

Count. If you have an Inclination to be acquainted with the other Tribes of these Creatures, their Wars as well as their various Policies, Inclinations and properties, you may, while you continue in the Country, make a Collection of all the Species of them in little Boxes;

Boxes ; but you must remember to supply them every Day with green Provisions suitable to their several Natures and when you have done this, you cannot imagine what an agreeable Amusement you will receive from the exactness and Regularity of their Operations.

Countess. For my part, I think the *Chevalier* is already very attentive to the Shells that are nearest their Change and seems to wait with impatience for the Resurrection that is to ensue.

Prior. How is it possible to be unaffected with this little Miracle of Nature ! Open one of these *Aurelias* they represent the Scene of an Insect's Progress from a Caterpillar to a Butterfly all you can discover, especially at first is an obscure Pap, or kind of Putrefaction ; in which every thing is confounded. But then this Putrefaction contains the Elements of a better State of Existence. These Humours transpire by Degrees, thro' the Film that incloses them ; the Film itself is gradually tinctured with a most beautiful Vermillion, and the Limbs and Features that at first were confounded in the Mass, begin to disengage themselves from the Case that contained them, and which now bursts open. 'Tis then that

The Head unfolds itself to View, the
orns lengthen, the Legs and Wings are
extended, and at last the Butterfly wings
Flight thro' the Air, and retains no
similitude of its former Condition.
The Caterpillar that is changed into a
ymph, and the Butterfly that proceeds
from it, are two Animals entirely dif-
ferent. The first was altogether terref-
trial, and crawled heavily along the
ground. The second is Agility itself,
and is so far from limiting his Motions
to the Earth, that he, in some measure,
ascends to repose on its Lap. The first
was all shaggy, and frequently of an
hideous Aspect. The other is array'd in
colours of the most beautiful Glow.
The first stupidly confined himself to a
poor Food; whereas this ranges from
Moss to Flower; regales himself with
Honey and Dews, and perpetually varies
his Pleasure. He enjoys all Nature in
full Liberty, and is himself one of her
valuable Embellishments.

Countess. The *Prior* has given us a ve-
ry agreeable Image of our own Resur-
rection.

Prior. All Nature abounds with sen-
sible Images of celestial Things, and the
sublimest Truths; and a real Profit per-
petually redounds from the Contempla-
tion of her Works. This is a Theology
that

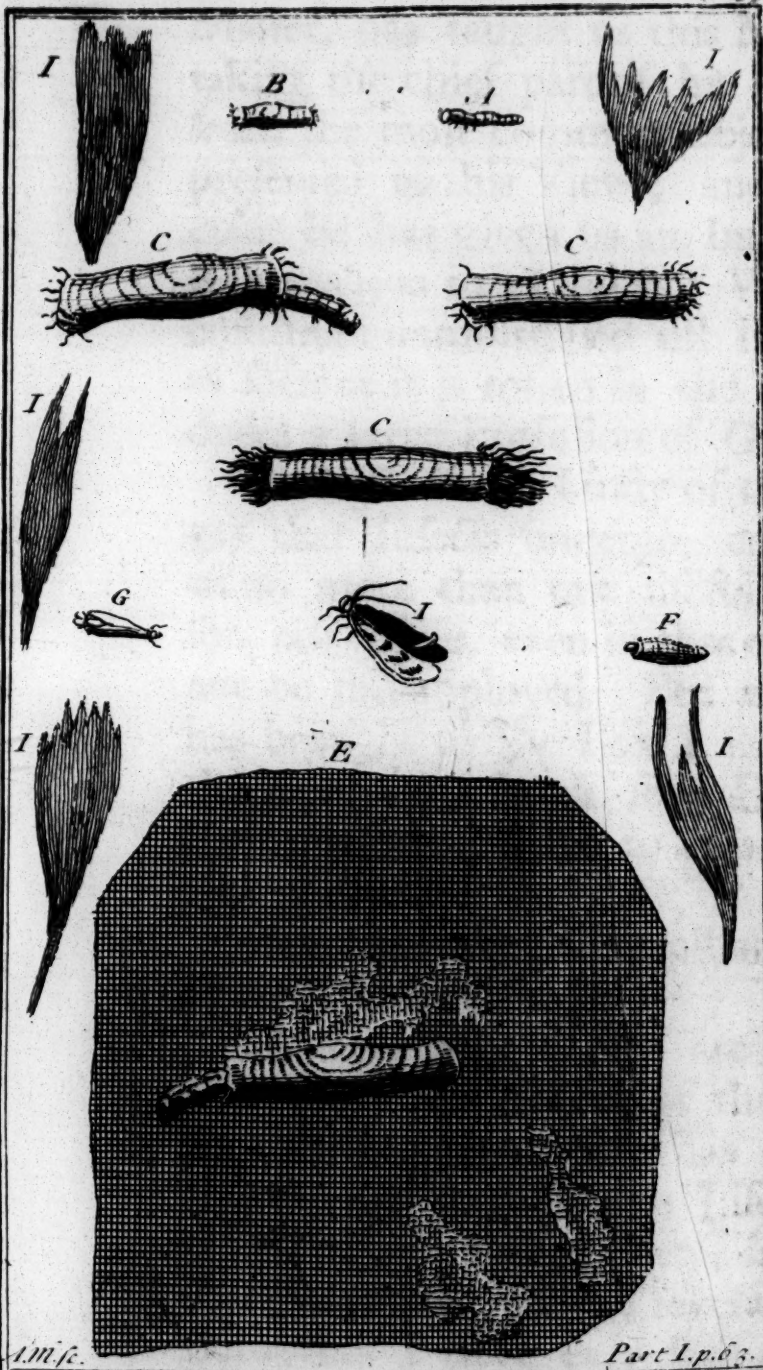
that is constantly well received, because it is always intelligible. The greatest of all Masters, or rather, our only Master, has taught us this Method, by taking the chief part of his Instructions from the most common Objects Nature presented to his View; and in particular he has given us an Image of the Resurrection in a Grain of Wheat, which continues unmultiplied till it dies; but as soon as it is rotten in the Earth produces a large Profusion of Grain.

Countess. If the Study of those Changes that Insects undergo, could afford us no more than one useful Comparison, our Time, even in that case, would not be misemployed. But my Servant has brought us the Box I was desirous the *Chevalier* should see: Here is the Key, Sir; be pleased to open it and divert yourself.

Chev. Are they Caterpillars that are at work in it?

Countess. No: They are Creatures risen from the Graves of those Insects, tho' their Resurrection has not added Immortality to their new Life. I have collected and pasted, here, in different Compartments, all the several Kinds of Butterflies I have ever seen; and as I learned to paint when I was very young I have copied each Butterfly from Nature.





A. M. f. c. Part I. p. 63.
A. The Moth. B. Feshure of q Moth. C. The Moth & its Vapure larger than q Life. D. The Fastenings. E. Stuff gnawed by a Moth. F. The Chrysalis. G. The same view'd from beneath. H. The Butterfly sprung from this Chrysalis. I. The Plumes of all sorts of Butterflies as seen thro' a Microscope.

under every Compartment, and likewise represented the Caterpillar *Aurelia* that are proper to each species, in their natural Colours and Dimensions. Examine the first Compartment you cast your Eyes on.

beu. What delightful Colouring is! Pray let us observe them in order and begin with the first.

Countess. Those Butterflies that make their Appearance in the Night, I have laid upon a Ground of white Sattin; their Shades and Colours are soft and agreeable, but not very shining; and they want to be heighten'd with White, to give them a better Effect. As all these Butterflies only appear in the Night, I call them my *Owl-Butterflies*.

I see them painted in the same order under the Compartment. Those Moths. the first Range represent Moths that lay on new Stuffs.

beu. They seem to be wrap'd up in a kind of Muff, out of which they extend their Heads and Bodies.

Countess. That Muff * is a Robe, or rather a House, which they themselves prepare. The young one, upon leaving the Egg that a Butterfly has lodged on a piece of Stuff, or a Skin well dressed

and commodious for her Purpose, immediately finds a Habitation and Fasteneth in the Nap of the Stuff, or Hair of Skin. It gnaws † and lives upon the Nap, and likewise builds with it an Apartment you see, accommodated both with a Fore-door and a Back one. The Whole is well fasten'd to the Ground of the Stuff with several Fillets, and a little Glew. The Moth sometimes thrusts her Head out of one Opening and sometimes out of the other, and perpetually devours and demolishes about her. But 'tis very pleasant to observe, that the Tent of this Creature is always of the same Colour with what she feeds upon; and when she has cleared the place about her, she draws out all the Stakes of this Tent; and which she carries it to some little distance on her Back, and then fixes it with her slender Cords in a new Situation. If she has been gnawing Red Wooll, and should afterwards find herself placed on a parcel of Wooll of green Die, her Habitation, which then was all red, is enlarged in its Dimensions, but at the same time comes tinged with Green, and perfectly corresponds with the Plain where

† Monf. de Reaumur.

ends her Pasture. In this manner she continues to live at our Expence, till she is fatiated with her Food, at which period she is first transformed into a *ymph*, and then changes to a Butterfly. I would not have the *Chevalier* believe all this to be only an agreeable amusement. For my part, I was willing, as a good OEconomist, to have the Knowledge of an Animal so destructive to our Furniture; and this Knowledge has likewise furnished me with a Remedy which is obtained by frequently rubbing the Tapestry and Curtains with a Lock of Sheep's Wooll that still retains its natural Fat. This discovery was made, by observing that the Moth always chuses Skins and Wooll that have been manufactured by the workman. Another Remedy is, to beat Stuffs and Tapestries well, before the Butterflies have laid their Eggs, towards the middle of the Summer; and be careful not to replace them in the Apartments till you have destroyed the Moths and Butterflies with Oil of Turpentine, or the Smoke of Tobacco. Let us now proceed to the second compartment, which begins with those Butterflies that appear in the Day. Their Size is generally larger, and their colours more lively. I always took
F care

care to fix them on a Sattin Ground, of a Colour contrary to that which appears in these Insects. In this and the next Compartment, you see no Colours but what are simple and uniform ; but in the fourth, you may observe them intermingled with one another. I have there opposed white to red, and yellow to blue ; all these Colours heightened and contrast each other, according to their different degrees.

In the last Compartments I have collected and ranged, with the nicest Judgment and Propriety I was capable of, all those Butterflies that are covered with Plumage, or tinged with a Variety of Colours. You may there see *French*, *Indian* and *American* Butterflies, as they have been brought to me from all Parts : each Country has its own Species, shaped in a peculiar manner. There is not one of these Creatures that has not a good Effect when the Eye compares it with the next ; and indeed most of them viewed singly, and independent of the rest, give pleasure to the Sight : sometimes by the rude, and sometimes by the soft Gradation of Colour into another, and the various Diminutions of the Tints. But above all, one is astonished at the Beauty of the largest of these Insects, where

seems to sport herself in the artificial Mixture and Display of all her most amiable and radiant Treasures. You will find in these Wings the Lustre and Variety of all the Colours in Mother of Pearl, you will see the Eyes that glow in a Peacock's Tail, and will find the Edges bordered with the Ornaments of shining Silks and Furbelows, the blending Dies of *Hungary Point*, and the Magnificence of rich Fringes. When I have any Furniture or Dress to adjust, 'tis here I come for Counsel. *Cherub*, you may take a full View of them if you please ; I only desire you not to press them with your Fingers, because you will rub off the Feathers. *Cherub*. Feathers, Madam ! I should imagine that what a Butterfly discovers us with could be nothing but dust. Whenever I have caught any of them, my Fingers were cover'd with fine Powder, of the same Colour with the Creature.

Countess. That Powder *, as these Gentlemen have shewn me, is a Cluster of little Feathers ending, at one Extremity, in a Quill, and, on the other, fringed and adorned with Fringe ; the extremity of one covers the Beginning

* Leeuwenhoek's Arcan. Nat. p. 3. Epist. 146.

of another. They are fixed in perfect Order, like the Feathers of Birds, and when you wipe them off, the Wing that remains is only a fine transparent Film, where you may discover the Sockets in which the Quill of each Feather was sunk. But that you may have no farther Doubt of this Matter, I will cast your Eyes upon the last Compartment, where I have scatter'd, upon a Layer of Grew the Dust of all sorts of Butterflies.

Count. Here's a Microscope, Sir, that will enable you to change this Dust into Feathers.

Chev. Nothing can be more certain than what the Lady has been declaring. Instead of discovering the least Grain of Powder, I see nothing but beautiful Plumes, whose Colours have a Liveliness and Variety that charm me.

Countess. Since you are not displeased, Sir, with my Amusements, I will entertain you To-morrow with my Silk Worms. It will give you a real Pleasure to see all the Labourers at work, especially when they are forming their Thread; but, unhappily for us, the Time is elapsed, and you must defer your Visit till the next Summer, and favour us with your Company three Months, instead of one.

The End of the Second DIALOGUE.
SILK



I L K - W O R M S.



D I A L O G U E III.

The Countess de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Countess.  HE *Count* has taken a little Journey for two or three Days; but for all that we may proceed in our conferences. Silk-Worms are to be a Speculation To-day; and we can enter upon this Subject without any assistance from Books or Learning. I have brought up so many of those features, from my Infancy, that I am able to entertain you with their Labours, and the Present we receive from them;

them; but 'tis possible the *Chevalier* may be as well acquainted with them as myself.

Chev. I have sometimes heard People speak of them, and several of my Friends breed them up in Boxes; but I was never suffer'd to have any myself and was even debarred from seeing those that belonged to others; so that one would have imagined these little Animals had been infectious.

Countess. Those were Prejudices indeed. For my part, I have had Silk Worms all my Life-time; tho' for some Years past I have resigned this Amusement to my Daughters: They feed them, keep them clean, and equally share them; they are intirely pleas'd with this Employment, and never find the least Inconvenience in it, because the Insect is very agreeable; and whenever it grows sick they throw it away.

Chev. I should take it as a very great Favour, Madam, if you would acquaint me how those, that are to be brought up, must be managed; and in what manner you make use of their Labours.

Countess. There are two Methods of Rearing them: You may let them thrive and expatiate in full Liberty up

the Trees that nourish them : Or you may keep them at Home, in a place particularly accommodated to that purpose, taking care to supply them every Day with fresh Leaves. The *Prior* has made an Experiment of the best Method ; and I will desire him to give us his Opinion of it.

Prior. 'Tis true : I had, some Years ago, the Curiosity to make this Use of the Mulberry Trees that grow under my Chamber-Windows ; and I lodged upon them a Number of Silk-Worms, that succeeded very well without my interfering in the least. They practise the same in *China*, *Tunquin*, and other hot countries. The Butterflies that spring from Worms, or rather Caterpillars, chuse a proper part of the Mulberry Tree to deposite their Eggs upon ; and there they fasten them, with that sort of Glew which most Insects are provided with for different purposes. These Eggs remain there all the Autumn, and Winter, without the least Injury ; and the manner in which they are fixed and disposed, shelters them from the Frosts that sometimes don't spare the Tree itself. The Young, assigned to the Care of an affectionate and tender Providence, never quits the Egg till its Sustenance is provided for

them; but 'tis possible the *Chevalier* may be as well acquainted with them as myself.

Chev. I have sometimes heard People speak of them, and several of my Friends breed them up in Boxes; but I was never suffer'd to have any myself, and was even debarred from seeing those that belonged to others; so that one would have imagined these little Animals had been infectious.

Countess. Those were Prejudices indeed. For my part, I have had Silk Worms all my Life-time; tho' for some Years past I have resigned this Amusement to my Daughters: They feed them, keep them clean, and equally share them; they are intirely pleas'd with this Employment, and never find the least Inconvenience in it, because the Insect is very agreeable; and whenever it grows sick they throw it away.

Chev. I should take it as a very great Favour, Madam, if you would acquaint me how those, that are to be brought up, must be managed; and in what manner you make use of their Labours.

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it, and the Leaves begin to shoot from their Buds : But when once the Leaves are expanded, the Worms break the Shells, and disperse themselves over the Verdure ; by degrees they increase in Bulk, and at the End of a few Months distribute, upon the same Tree, little Balls of silken Thread, that look like golden Apples amidst the beautiful Green that embellishes and contracts them. This Method of nourishing them is most conducive to their Health and occasions the least Trouble ; but the Inequality of our Climates makes it liable to many Inconveniences that are not to be remedied. 'Tis true, we might with Nets, or some other Invention, preserve the Worms from the Depredations of the Birds ; but the Severity of the cold Season which frequently succeeds the first Heats, and besides the Rains and violent Winds, make a general Destruction. 'Tis necessary therefore to bring them up in the House, in the manner her Ladyship practises ; and I beg the Favour of her to let us know the Particulars.

Countess. We chuse a Room in a good Air †, and where the Sun has free Admission ; it must be defended from the

† Marc. Hieron. Vida Bombyc. 1.

Blasts, by Windows well glazed, or Frames of strong Cloth. Care must likewise be taken that the Walls are well plaistered, and the Floor very firm. In word, all the Avenues must be inaccessible to Rats and Birds. In the middle of the Room you must raise four Columns or Pieces of Wood that may form a large Square, from one Column to the other; several Hurdles, made of Osier Twigs, must be extended in Ranges one above another; and under every Range there must be a Floor, bordered round with a Ledge; these Floors slide into a Groove, and may be fixed or displaced at Pleasure.

When the Worms have left their Eggs, 'tis customary to spread some Their Suf-
tenance. soft Leaves of the Mulberry Tree over the Linen or Paper of the Box in which they were hatched, and which is then large enough to contain a great Number of them. When they have gained a little Strength, they must be distributed upon Beds of Leaves, along the Ranges of the Square that is in the middle of the Room, and round which there should be a free Passage. They fasten upon the Leaves, or else on the Osier Twigs, when they have eat the leaves. They are then furnished with Thread, by which they suspend themselves

selves as they have occasion ; and by this means avoid the Shock of a Fall. Every Morning they must be supplied with fresh Leaves lightly scattered over them in a uniform manner. The Silkworms upon this immediately quit the old Leaves, which must be all removed and care taken that the Insects are not carried away with them : and therefore 'tis necessary to employ a discreet diligent Servant, whose Business must be to feed and keep them clean in a proper manner ; for nothing hurts these Creatures so much as Moisture and Uncleanliness.

In order to preserve them from the Distempers to which they are subject the first Care of the Governess should be, to gather Leaves for them in a dry Season, and preserve them in a Place where no Moisture can come ; she must likewise do this before the Rains fall that she may not be obliged to dry the Leaves, and make her young Nursery sometimes fast, which would soon be very prejudicial to them ; for these minute Animals being to live but a short Period, make the best of their time, and are always eating to the very last Season of their Moulting ; after which they continue to live almost as much longer without feeding at all. When the
Mul-





mulberry Leaves happen to fail, you may, till there is a new Supply, give them the Leaves of Lettice or Holly-husk, tho' this is a Collation they have very little relish for. Necessity alone obliges them to submit to it; and the Mark they then spin has evident Marks of the Cessation of their usual Food, and proves but indifferent.

There is another Precaution almost necessary as the choice and good management of their Provisions, and that is, to let fresh Air into the Room from time to time, in a full Sunshine; and to keep as neat as possible, not only the Floors appointed to receive the fragments of their Leaves and other impurities, but likewise all the Place in general.

Cleanliness and good Air greatly contribute to their Welfare and Growth. We now come to the different Stages thro' which they pass.

The Worm when it leaves the Egg, extremely small, it is likewise perfectly black; but its Head is of a more shining Sable than the rest of its Body. In a few Days it begins to assume a whitish Hue, or an ash Grey. After this its Coat fullies and becomes ragged, at which time the Animal casts it off, and appears in a new Habit. It

increases in Bulk and grows whiter, than a little tending to the Green with which it is replenished. After a few Days which vary according to the degree of Heat, the quality of its Food, and the Constitution of the Animal, it ceases to feed, and sleeps almost two Days; at the End of which 'tis exceedingly agitated and tormented, and grows almost red with the Efforts it uses. Its Skin wrinkles and shrinks into Folds, and the Animal then divests itself of it a second time, and throws it aside with its Feet. It now appears in its third Habit, and very magnificent it is, considering it is furnished out in the Space of three Weeks or a Month. It begins to eat again, and you would then take it for another Animal, so different are its Head, its Colour, and whole Form, from what they were before. After it has continued eating for some Days, it relapses into its Lethargy; at the Conclusion of which it quits its Covering, as usual: That is to say, it divests itself of three different Skins from the time it leaves the Egg. It continues feeding some time longer; and at last entertains a Disrelish of the World and its Enjoyments: It renounces all Feasts and Society, and prepares for Solitude by building, with its Thread, a little Cell

ell of a ravishing Structure and Beau-

But before I introduce it into this
 mansion, I should be glad to be in-
 formed by the *Prior*, who has careful-
 examined all these Operations, what
 the inward Arangement of a Silk-
 Worm's Body ; and from whence it re-
 ceives the Materials of that beautiful
 thread it presents us with ; and how
 the Creature manufactures it. You
 learned People discover that with your
 glasses which eludes the most attentive
 eyes.

Prior. In a few Words, Madam, this
 is the Anatomy of a Silk-Worm ; at
 which you may assist with all imagi-
 nable Decency. This Worm, like o-
 ther Caterpillars, is composed of seve-
 ral elastick Rings, and well accommo-
 dated with Feet and Claws, to fix itself
 in a convenient Situation. It has a lit-
 tle Skull, to cover the Substance of the
 Brain, which descends and is commu-
 nicated by small Vertebrae, from one
 extremity of the Body to the other*.

The Ana-
 tomy of
 a Silk-
 Worm.

It has two Rows of Teeth in its
 mouth ; which don't move up and
 down, like ours ; but work from the
 right to the Left : These Teeth en-
 able it to saw and dilacerate the Leaf.

Leeuwenhoek, Arcan. Nat. Tom. iii. Ep. 146.

When

The
Spine.

The
Heart.

The
Lungs.

When the Animal cuts it, she presses one side of the Leaf, and proceeds with a descending Motion, as we ourselves would cut it with a Pair of Scissars by continuing from the Top to the Bottom *. One may easily distinguish the Palpitation of its Heart, which cannot be performed without proper Vessels to circulate a Fluid thro' the whole Body. From the Head, to the Extremity of the Tail, is extended a kind of little Nerve, which we call the *Spine*; because it incloses, in the Joints that form it, a Marrow like the Brain: This Spine, that is placed in the middle of the Body, and continues thro' its whole Length, sustains two other Nerves or Strings very like Chaplets. One of these, which is the Heart, is composed of many oval Vessels. The other, which is the Lungs, is double and appears to be an Assemblage of several Rings, that extend towards the two sides of the Animal, and between which are certain Orifices that correspond with those we see distributed along the exterior sides of a Worm. It is thro' these Openings that the Air flows into the Lungs, and by its Spring and Expansion promotes the Circulation of the

* Malpigh. *ibid.*

Chyle or Humour that nourishes the Silk-Worm, as we have found by Experience. Drop a little Oil upon the Head, the Back or Belly of this Insect, it will still continue alive; but if you rub Oil, Butter, Sewet, or any other such fat and thick Matter, on the Sides of the Creature, you then obstruct the Vessels that convey the Air to the Lungs; and accordingly it immediately falls into Convulsions and dies in an Instant, unless you relieve it by renewing the Communication of the Air.

Around these two Chains or Strings, which constitute the Heart and Lungs, lies the Ventricule and Intestines, where The Intestines. the Digestion is performed. The whole System of these Vessels is encompassed with almost innumerable Folds and Windings, formed by a very long and little Bag that contains a sort of Gum, The Bag of Gum. coloured like a Marigold, of which the Worm makes its Silk.

You may have sometimes seen, in the Work-rooms of Goldsmiths, or Gold-Wire-Drawers, those Iron-Plates that are pierced thro' with Holes of unequal Dimensions, thro' which they draw, and lessen at pleasure, Gold or Silver Wire. These Plates are called Wire Drawing-Irons. The Silk-Worm has, under her Mouth, such a kind of In-

Their
manner of
Spinning.

Instrument perforated with a Pair of Holes, thro' which she draws two Drops of the Gum that fills her Bag. These are like a couple of Distaffs, that continually supply the Materials out of which she spins her Thread. She fixes both these Drops where she pleases, and then draws back her Head, or lets herself fall. The Gum that flows thro' these Openings receives their Form, and lengthens into a double Thread, which immediately loses the Fluidity of the Liquor that composes it, and acquires Consistence sufficient to sustain or enfold the Worm at the proper Season. She is never deceived in adjusting the Dimensions of the two Apertures, or calculating the due Thickness of the Thread: She always makes the Strength of it proportionable to the Weight of her Body. She unites the two Threads by glewing one over the other with her Fore-paws; and when the time for making her Cone comes, she employs the Fingers that her Paws are furnished with, in either twisting or glewing the two Threads together, or fixing her Silk sometimes in one Place and sometimes in another; and I assure you, I have frequently stood still to observe the graceful Attitude in which she spins.

ns, as well as the Industry that shines
to' all her Work.

It would be a very curious thing to
how how this Gum, that composes
the Thread, is separated and drawn off
from the other Juices that nourish the
animal. It must be accomplished like
Filtrations and Secretions of some
humours which are formed in an human
body. I am almost persuaded that the
Silk-Worm, at the Entrance into the
Silk Bag we have been describing, is
furnished with a Set of little Glands,
which being originally impregnated
with Gum afford a free Passage into
the Bag, to all the Juices of the Mul-
berry Leaf that correspond with this
Gum, and exclude every Fluid of a
different Quality. As to the Remainder
of the Aliment, one part, by Virtue of
its Fineness, is received into little Ves-
sels which convey the Chyle, or nutri-
tious Juices to the Heart. The other
part, which is the Dregs, meets with
Stomachs proportioned to its Grossness.
I tire you with my Dissertation,
I find, that whenever the Countess
is present, 'tis all lost time to the Che-
erfulness.

Let me have your Ladyship's
permission to contradict the *Prior* a
Moment's Un-

G

easefulness

easiness in his Conversation, and when I find any Difficulty in his Descriptions, I am eased of it by bringing him upon the same Subject another time. But I confess I am very impatient to know how the Silk-Worm and other Caterpillars, wrap themselves up in their own Thread; and how they can work it into an Habitation or Tomb.

Countess. I have picked up by Chance two or three Cones of those Worms who finished their Work a little later than the rest. They are laid in a Paper, and I must give the *Chevalier* Sight of them.

Chev. How, Madam! are the Silk-Worms within?

Countess. Yes, like Solitaries in many Hermitages; let us take the Scissors and cut open the Cones.

In the first place, take notice of the Down or Flue, which is the Heap of bad Silk you see there, scatter'd at the Venture, and taking up a great deal of room. In the next place, you will find the fine Silk all compact, and ranged with the utmost Propriety. And, lastly, observe the Bag, which is a Composition of Silk and Glew, and resembles a very strong Stuff. Within that you will find the Worm in Miniature, and

changing

anged into a *Nymph*. Take it in your hand.

Chev. 'Tis made like a Bean, without Feet, Head, or any distinct Part: we may see, however, several little rings that gradually diminish towards the Extremity, and have some Motion when they are pressed.

Prior. 'Tis the *Nymph* that incloses the Body of the Butterfly: The Wings, Feet, Eyes, Horns, are all there now; in a manner not to be distinguished. In fourteen Days hence the whole will be engaged.

Chev. But if the Silk-Worm is concealed under the Down when it spins regularly, how is it to be known in what manner it has raised all this in work?

Countess. Nothing is more easy: when it is satiated with Leaves, and of Time for its last Transformation arrived, it seeks for a Place where it may build itself an Abode without interruption. We usually give it some of the Twigs of Broom, or a piece of rag, or paper rolled up, into which it retires, and, lastly, begins to move its Head to different Compositions, in order to fasten its Thread on every side. All this first Work looks that you call Confusion, but it is not without design. The Worm neither arranges

its Threads, nor winds one over another, but contents itself with distending a sort of Cotton or Flue, to keep off the Rain; for Nature having ordained them to work under Trees, in the open Air, they never change the Method of sheltering themselves.

When my Curiosity led me to know how they spun and placed their beautiful Silk, I took some of them, and frequently removed the Flue with which they first attempted to make themselves first Covering; and as I weaken'd the exceedingly, when they were at last tired with beginning a-new, they fasten'd their Threads upon what came in the way, and began to spin very regularly in my Presence, bending their Heads up and down, and then crossing to every side. The Worm, at that time, confined its Motions to a very contracted Space, and by degrees had intirely surrounded itself with Silk. The Remainder of the Operation is invisible, but one may guess how it was accomplished. The Animal, to finish its Mantle, drew out of its Bag a Gum which it spun into a less delicate Substance, and then thicken'd it with a strong Glew, which served to bind all the Ranks of this Silk over one another.

Here then are three Coverings intire-
different, which afford her a Succes-
of Shelter : The Flue keeps off the
in ; the fine Silk forms a Tissue that
events all Access of Air ; and the Silk
which is glew'd, and form'd into a
ell that touches the Worm, not on-
repels the Water and Air, but also
ders the Inside of this Habitation
ccessible to the Cold. After she has
n in this Retreat long enough to be
nged into a *Nymph*, by divesting
self of her fourth Skin, and to be
nsformed from a *Nymph* into a But-
ly by a gradual Expansion of her
rns, Wings and Feet, that were
wed up and enfolded in her Skin,
then time for her to make her
pearance.

Obv. That must be a difficult Affair.
ne provided either with Saws, or a
plet, strong enough to pierce thro'
Shell, the Silk, and the Down ? In
Opinion she seems to be strongly
nured.

Mountefs. That Being who teaches the
rm how to build herself a Place of
s, where the delicate Limbs of the
Animal may be formed without In-
ruption, instructs that new Animal
wise how to open a Passage for its
ht. The Cone is like a Pigeon's
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Rain ; the fine Silk forms a Tissue that
prevents all Access of Air ; and the Silk
which is glew'd, and form'd into a
Shell that touches the Worm, not on-
ly repels the Water and Air, but also
renders the Inside of this Habitation
inaccessible to the Cold. After she has
remained in this Retreat long enough to be
changed into a *Nymph*, by divesting
herself of her fourth Skin, and to be
transformed from a *Nymph* into a But-
terfly by a gradual Expansion of her
Limbs, Wings and Feet, that were
rolled up and enfolded in her Skin,
it is then time for her to make her
appearance.

Query. That must be a difficult Affair.
How is she provided either with Saws, or a
Piercing Instrument, strong enough to pierce thro'
the Shell, the Silk, and the Down ? In
my Opinion she seems to be strongly
endowed.

Answer. That Being who teaches the
Worm how to build herself a Place of
Retirement, where the delicate Limbs of the
Animal may be formed without In-
convenience, instructs that new Animal
likewise how to open a Passage for its
Escape. The Cone is like a Pigeon's
Egg,

Egg, and more pointed at one End than it is at the other. The Worm does not interweave its Silk towards this Extremity, nor apply its Glue there, as it does in every other Part, bending itself all around with great Agility of Body and Pliantness; and lastly, she never fails to bend her Head to the pointed Extremity; and I will acquaint you with the Reason: This Part is not so strongly cemented, nor exactly closed as the rest. She is conscious this is to be the Passage for the other Animal she carries in her Bowels, and has therefore the Precaution never to place this Extremity, or pointed End, against any Body that might obstruct the Creature at the Season of its Egress. When the Worm has exhausted itself to furnish the Labour and Materials for these three Coverings, she resigns the Form of a Worm, her Spoils drop off, and she is converted into a perfect Butterfly till the Expiration of fifteen days, or three Weeks, and sometimes a longer Space of Time. This Butterfly, when its Formation is completed, extends its Wings together with its Head and Feet towards the Point of the Cone, which, not being closed up in that place, gradually yields to its Efforts: it

ges the Opening, and at last comes
th. At the bottom of the Cone the
ins of its former State are to be
and, I mean the Head and intire
in of the Worm, which then bear
ne Similitude to an Heap of foul
men. I forgot to acquaint you that
e Butterfly, before it quits its Reposi-
y, frees itself from the Superfluity
that Humour which contributed
form and fortify its Limbs. This
acuation soils the Ball, and very much
mages the Silk.

Chev. What becomes of the Butter-
after this?

Countess. It wanders to a little dis-
ce from the Place it quitted. The
le is more lively, and smaller than
Female. She is bigger because she
full of Eggs, which she lays a few
ys after; and if they have any Fe-
dity, they change their Complexion
the approach of Spring, from a yel-
Citron to a blueish Cast, and after-
ds an Ash grey.

Chev. At present, Madam, I am
ious to know in what manner you
d off the Silk, and how you use it.
if the Butterfly, before it forsakes
Cone, evacuates a Liquor that cor-
ts it, and if she likewise pierces a Hole
it, it must certainly be all spoiled.

Countess. That is true ; but there is no use made of those Cones which are pierced in this manner ; and before this, Care is taken to prevent that inconvenience. A Female Silk-Worm sometimes lays above five hundred Eggs. You see we need but a very small Number of *Nymphs* to stock the Laboratory for the ensuing Year. As to the other Cones from whose Silk we propose to make any Profit, are exposed in the open Sunshine, which in spite of all these different Tissues penetrates to the *Nymph*, and kills her in less than six or seven Hours, and before she has soiled any thing.

Prior. The *Chevalier* will be dissatisfied, unless we likewise teach him how to wind off the Silk.

Countess. When we intend to separate the Silk from the Cones, the Down must be cleared away, in the first place ; and the Cones, with their Silk, are then thrown into warm Water ; where they are stirred about with Sprigs of Brood in order to come at the heads or beginnings of the Silk. These are drawn thro' little Rings, to prevent the Cones from rising too high when the Silk is fastened to the Reel, and you begin to wind it. They also join together the Silk of several Cones, to a certain number.

er, as fix ; but generally eight, and sometimes more, according as the Silk intended to be made more or less strong. The Cones remain in the Water till they cease to furnish any more Silk. But those that work it, don't wait till it is all wound off; because it changes its Colour and grows weaker towards the End. But even this last part of the Silk is not without its beauty, and they preserve it by itself. As to the Cones, they are useful on several Occasions. Some People stain them with a Variety of Colours, and form them into artificial Flowers, which are sometimes finished with the utmost perfection. The common Practice is, to leave them in the Water till all the Grew be evacuated, and then they are carded like Wooll, and yield a kind of broken Flax ; which is spun with a Wheel, in order to weave it into Stuffs of a moderate Value. But I am very indiscreet to trouble you with all the Particulars of this Work. Make the *Prior* a Visit, Sir : He has invented a wheel of a particular Form, with which you may learn to wind off the Silk very judiciously.

Prior. It was merely to satisfy her Ladyship's Curiosity, and to know the exact Length of the Silk produced by these

these Worms, that I ordered a little Reel to be made, each of whose four Sides contains three Inches in Length. But since I have completed my Experiment I renounce the Trade for the future.

Countess. But what do you gain by these three Inches?

Prior. The four Sides taken together are equal to twelve Inches, or a Foot; I am sure then, that each Turn of the Silk upon the Machine is equivalent to that Measure, and sometimes a little more; because the Rounds are enlarged when they fold over one another. At every Turn of the Handle I wind off a Foot of Silk; I have only then to reckon how often I turn the Handle of the Wheel for one Silk-Worm, in order to know at the same time how many Feet it produces.

Countess. You are certainly in the right; and have you made the Experiment, Sir?

Prior. I made it upon two Cones of Silk, and found nine hundred and twenty-four Feet in one, and nine hundred and thirty in the other. Take notice, if you please, that the Thread is double and glewed one over the other.

* Boyle de Subtilit. Effluv.

ro' its whole Length, which consequently amounts to near two thousand Feet of Thread.

Countess. We must only compute nine hundred and thirty, because we receive the Thread in the same Condition from the Silk-Worm. I assure you I did not expect half that Quantity, and intirely depend upon your Exactness.

Prior. Besides this, I made another Remark: I weighed the nine hundred and thirty Feet of Silk. The *Chevalier* shows that a Pound contains two Marks, a Mark eight Ounces, an Ounce eight Drams, a Dram three Penny-weights, and a Penny-weight four and twenty Grains; which last is a Weight so inconsiderable that a Breath of Wind easily wafts it away. The nine hundred and thirty Feet of Silk weighed with the greatest Exactness, were no heavier than two Grains and an half.

Countess. Do you know the Difference between this Thread, and that which is made by the expertest Spinster in the World?

Chev. The same that there is between a Rope and a String of Pack-Thread.

Countess. Rather say, between a Needle and a Cable. But let us take a Walk, Gentlemen, and enjoy

joy the Benefit of the Air. What shall be the Subject of our Conversation To-morrow?

Prior. What your Ladyship please to appoint.

Countess. In reality, I am very much tempted to be one of your Party. But it shall not be said that you admit me into your Society merely to do me Honour, I will be faithful to the Laws of the Company, and intend to assist regularly at your Assemblies; but, if you please, it shall be upon Condition that you confine your Speculations to my Capacity: As many Remarks as you please on the Things I know. Let us talk of Gardens, Pulse, Fruits, and domestick Animals: I have some small Acquaintance with what we see every Day; but pray don't pretend to make me soar to Heights I can never reach.

Prior. You, yourself, Madam, shall be our President, and regulate the Subject of our Conferences.

Countess. I take you at your Word, and, if you please, we will pursue our Subject of Spinning: A few Days ago you gave a Description of a Spider's manner of working, and you may remember the Pleasure with which your Account was received. No one expected to find so much Skill and No-

ty in an Animal that makes such a agreeable Appearance. *Chevalier*, I promise you this Description for your entertainment To-morrow; but advise you to do one thing before hand.

Chev. What may that be, Madam?

Countess. To pass away a little Time with some Weaver, they are numerous enough in this Country; and it may be proper for you to be very exact in observing how they make our Cloth, that you may more easily comprehend the description the *Prior* will give us of a Weaver's Method of working; in reality, the one will assist you to understand the other: You must expect, indeed, to see very poor People; but their Trade will give you abundance of Satisfaction, and the Invention of it is ancient; it will appear a Novelty to you; you will meet with a great deal of Ingenuity here, and return very well satisfied with my Advice, as well as with what you shall happen to see.

Chev. Will your Ladyship be pleased to let me take one of your Servants with me, to shew me the way.

Prior. With your Permission, Sir, I will all charge myself with that Care, and as proper I should be there to serve you as an Interpreter. These good people speak a Language that you are quite

quite unacquainted with, and I am now very certain that they will understand yours.

Countess. Chevalier, pray accept of these two Crowns, perhaps you may be unprovided with Money, and it is proper to make them a small Acknowledgment; when you speak to them by a Present, you need no Interpreter.

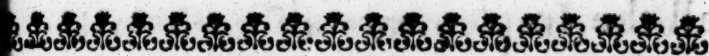
The End of the Third DIALOGUE.

4 AP 64





P I D E R S.



DIALOGUE IV.

The Countess de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Countess.



Hevalier, before we
come to your In-
sects, I should be
glad to know your
Thoughts of a Wea-

s Loom; do you now distinguish
Warp * from the Woof †?

The Warp is the Thread which is fixed on the

The Woof is a Thread that passes with the Shut-
tles the Warp.

Chev.

Chev. I am Master of all this, and can tell you the Use of the Treadles and Stays †, as well as the Comb Shuttle ‡, and ———.

Countess. He is going to tell us the Name of every part of a Loom. fancy you did not think your Entertainment low or disagreeable.

Chev. Nothing ever amused me better, and I am very desirous of seeing all the Implements of each Artisan one after another. I cannot comprehend why they should be concealed from us. If by chance you stop to take a View of an Handicraftsman's Work, you immediately meet with People who, with a very serious Air, ask you what you are amusing yourself with, and give you to understand that you are attentive to what is much beneath you.

Countess. I am exceedingly pleased with the *Chevalier's* Chagrin, the

* The Treadles are pieces of Wood which the Weaver alternately lowers with his Feet, in order to raise and fall the Stays.

† The Stays are two Ranges of Threads hung by Pullies, the working of which alternately raises and falls some part of the Thread of the Warp.

‡ This Instrument is a long Comb, cross which pass all the Threads of the Warp, and which serves to compact the new Thread with the preceding.

§ The Shuttle is a little Instrument made of Box-wood in the Form of a Ship; in the Middle of which the Weaver inserts the Woof, that plays off thro' a little Hole.

ay make a great Affair to him, if they
afe, of his *Latin*, and other necessary
ences; but why should he not be like-
se permitted to amuse himself with
e most common Employments of Life,
t are constantly practised?

Prior. There would be something
uch above a mere Amusement to be
ned by it. The Judgment would be
tivated, because it would acquire just
as of every thing in an agreeable
anner. The View of Arts and Pro-
fessions, and of Men in all Situations
Employments, affords a perpetual
ource of Experience intirely calcu-
ed to give Instruction without Ex-
nce or Fatigue. We there learn not
y whatever is capable of enriching
Mind, and embellishing Conversa-
n, but likewise that which makes a
n useful, and of Consequence upon
Occasions. Her Ladyship's Son, who
certainly one of the most refined and
able young Gentlemen one can pos-
y see, has been educated in this Taste.
er he had been completely versed,
different Masters, in all the necessa-
Tongues and Sciences, the Article
travelling began to be thought of;
the *Count* would not suffer him to
to *Germany*, where he now resides,
he had devoted every Morning, for

a whole Year, in the Study of natural Philosophy, or the most amiable Part of Nature ; and besides this, his Afternoons were generally employed in observing, as well as learning to a certain degree, the noblest Trades and Professions, without disdain even the most common. He never passed a Week without going to School at some Shop in *Paris*, not in a superficial manner but by making it his serious Endeavour to get a competent Idea of the real Object and most valuable Method of each particular Trade. He attended a Gold-Wire-Drawer, a Printer, a Clockmaker, and a Dyer, for near three Weeks. He bestowed as much time on a Joiner, a Smith, and even a Carpenter ; and never left his Master till he had seen him in all the Forms and Undertakings of his Profession. The repeated View of the same Works, the plain Conversation of the Artisans, the Approbations or Complaints of the Masters, the various Difficulties, Precautions and Remarks of the Buyers, made every Art and Trade so familiar to him, that at present he knows each Particular that relates to the Commerce of Life, as well as even those by whose Labours it is supplied.

he knows the Names and Use of all the Tools, is acquainted with the Materials employed by the Workmen, as well as the Countries that produce them; understands the Marks of their good and bad Qualities, and what they are worth either at first or second hand. He can distinguish the Touches of the Artist, and discern the Difference between a Work of Solidity and good Taste, and one that only strikes the Eye, but is of a slight Texture. A dishonest Workman can never impose upon him; but then he likewise knows how to do Justice to the Performance of an able Master: Nay, he goes farther, he is an Artist himself, and makes whatever he has occasion for with his own Hands.

Countess. I allow you to enlarge on my Son's Commendations, because you have so great a Share in them yourself. I have infinite Obligations to you, Sir, and can't imagine what peculiar Dexterity you practise; but when you used to disengage yourself a few Hours sometimes, from your common Employment, to take a Walk with my Son, you gave him a Taste of the Manuscripts and Sciences in a manner that charmed him. Your Method, as it appears to me, was not so much to make

him barely apprehend several things in Succession, as to raise in him a Desire to understand them ; your Intention was to make him curious, because Curiosity is an active Passion, that can never be indolent ; and when this Point is once accomplished, all the rest come without Reluctance or Distaste. I have frequently taken notice that your Discourses and Compliances, nay your very Diversions, only tended to sharpen the Youth's Curiosity. It was very pleasant, for Instance, to see the Curate and his little Parishioner disputing sometimes by the Water-side, while the Stones were the flattest ; and then to observe each of them raise his Heap, and with a kind of Emulation skim the Stones along the Surface of the Water, and when they were weary of this Employment, to sit down and make Dissertations on the Descent of Bodies, the Level of the Water, the Lines of Incidence and Reflexion, as I think they called them, the Pressure of the Air, and several other Matters that are slipped out of my Memory. When this Dialogue was over, they went to work with their Sticks on the first smooth Bed of Sand they saw, there they traced out the *Holy Land*, *Italy* or *France*, and even proceeded to the *Indies* and *Canada*.

Canada; and if they wanted Sand, they made use of Stones, Leaves and Apples, with which they sketch'd out Provinces, Mountains or Cities: Every day produced some new Invention. It is impossible to describe the Air and Delight, with which my Son repeated these Performances in my Presence; every thing was so familiar to his Imagination, and so well methodized in his head, that whatever he had learned in this amusing manner was repeated to me in a very exact Order, and the *Prior*, without knowing it, gave Instructions to two Persons instead of one.

Prior. As I was his Pastor, I could not employ my time better than in giving him some Curiosity; but when one meets with a fine Genius, it is impossible to be too sedulous in preserving him from every disagreeable Impression. And I can assure you that I have employed no part of my time with so much Advantage, as that which I have passed away in little Amusements with these amiable Youth.

Countess. There are but too many of these Amusements are no more than trifles, and indeed few are capable of giving them an agreeable Turn, or can mix Design with their Diversions, and

promote Virtue by the Mediation of Pleasure.

Chev. I must give you, Madam, another Instance of the *Prior's* Abilities. When he had explained to me, Yesterday, all the Parts of a Loom, and shew'd me how they were used : *Well, Madam*, James, said he to one of the Workmen, *will you let me have your Place? it is my turn To-day.* Upon which he immediately put the Treadles and the Shuttle in Motion, promising to pay me Pence for every Thread he should happen to break. After which he ask'd me, if I would *handle the Loom on the same Terms?* *Why not,* replied I? Upon which the Gentleman gave me his Place, and I began to work; but —

Countess. Didn't you spoil all?

Chev. It went on very indifferently at first, and I paid the Fine agreed upon, which cost me some Money; but I was in a little time as dexterous as another. Our good People were highly delighted to see their Work all wrong, and every broken Thread was as good to them as a Victory.

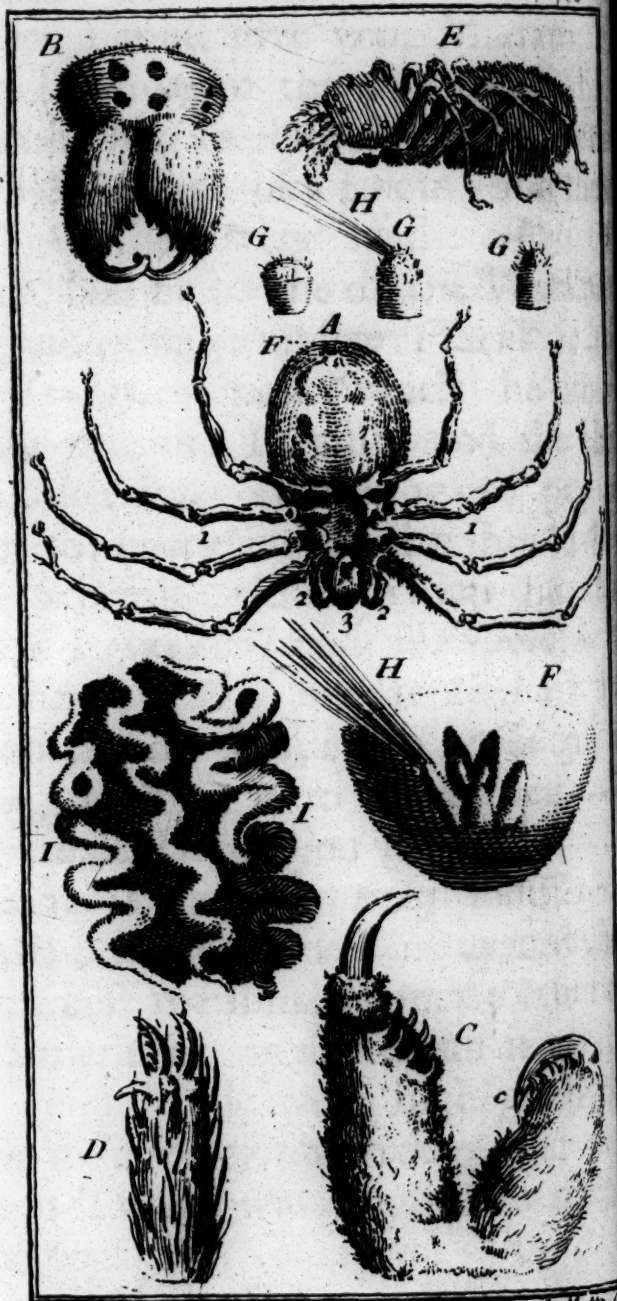
Prior. Well; let us talk no more of the *Prior* and the Weavers, but come to a Web of another Make, that requires neither Loom nor Shuttle; but your Ladyship will not be offended if I de-

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cribe the Spider and her Tools, before
speak of her Work.

Countess. Go on, Sir ; you may talk
of Dragons and Serpents, who are as
little disagreeable to me ; for the De-
scription of the most frightful Objects
capable of creating Pleasure.

Prior. There are five sorts of Spiders* :
first, the House Spider, who hangs her
Web in neglected Apartments ; second-
ly, the Garden Spider, who weaves in
the open Air a little round Web, the
center of which is her Situation in
the Day-time ; thirdly, the Black Spi-
der, to be met with in Cellars and the
cavities of old Walls ; fourthly, the wan-
dering Spider, who has no settled Nest,
like the others ; fifthly, the Field Spi-
der, which they call the Spinner.

All these Spiders have something in
common with each other, and likewise
something that distinguishes them. Let
us, in the first place, consider what they
all agree in.

Every Spider has two Parts, of which
the Fore one, that contains the Head
and Breast is separated from the Hinder-
part or Belly, by a Ligature, or very
tender Thread. The Fore-part is co-
vered with very strong Scales, and so are

The Fore-
part of a
Spider.

* Memoirs of the Academy of Sciences. M. Hom-
g. Leeuwenhoek's Arcan. Nat. Tom. iii. Ep. 138.

the Feet, that join to the Breast. The Hinder-part is clothed with a very supple Skin, and the whole invested with Hair. In different Parts of the

The Eyes. Head they have several fine Eyes, generally eight, and sometimes no more than six, two in the Fore-part, two in the Hinder-part, and the rest in the sides of the Head. They are all without Eye-lids, and are covered with a hard, polished, and transparent Crust. As these Eyes are immoveable they have been multiplied in this manner, to give them Intimations on all sides of whatever relates to them. All these Creatures, in the Fore-part of the Head have two Stings, or rather Branches shagged, or indented with strong Points like a couple of Saws, and ending in a Nail made like the Claw of a Crab. Near the Point of the Nail is a small Aperture, thro' which, 'tis evident, they eject a very violent Poison. They have no Arms so formidable to their Enemies as these. They open or extend the two Branches as they have occasion. When they no longer make use of the Nails, they bend and bring each of them down upon its Branch, like a Pruning-knife clasped upon its Handle.

The Legs. They all likewise have eight Legs jointed like those of Cray-Fish; and

The Extremity of these Legs, three hooked and moveable Claws, that is to ^{The} say, a small one placed on the side, like ^{Claws.} Spur, by the Assistance of which they fasten themselves to their Thread; and two others of a larger Size, which serve them to fix themselves where they please, and to slide either obliquely, or with their Back downwards, by grasping whatever comes in their way. But when they march over a Body whose surface has no Inequalities, as a polished Stone, or a Looking-glass, they strongly press a little Sponge, placed ^{Their} between the Claws at the end of their ^{Sponges.} feet, and squeeze out of it an humid dew that fixes them, without rendering them incapable of continuing their progress. Flies have such Sponges as these at the Extremity of their Feet; and from the Compression of them proceed most of those little round stains we see upon the Glasses of our mirrors, as well as *China*, and every thing else that is perfectly well polished. Besides these eight Legs, Spiders have two others inserted into the re-part of their Body, and which we may call their Arms, since they do use them for transferring themselves from one Place to another; but only for holding and turning their Prey.

But

Their
Thread.

But with all this formidable Equipage the Spider would be unsuccessful in its Wars, if she was not as well accommodated with Instruments to form an Ambush, as with Weapons for an Attack. She has no Wings to assist her in the Pursuit of her Prey, whereas her Prey is furnished with them for its Escape, and there would be too much Disproportion in their Circumstances if the Spider had not received a Thread as well as a natural Industry to spin it into a Web and Snare, which she spreads in the open Air, thro' which her Prey is continually passing and re-passing. Instinct informs her when to set about her Work, and she begins when her Prey first receives its Birth, and then retiring into Obscurity behind her Net, she patiently awaits the Enemy, to whom she herself is invisible.

I shall now describe the manner in which she weaves and completes a Web so advantageous to her Purpose. All Spiders, at the Extremity of their Bellies have five Teats, or Papillæ, covered with others of lesser Dimensions, the Orifices of which they open and shut as well as contract and dilate at pleasure. Thro' these Orifices they discharge that clammy Gum with which their Belly is replenished; and whilst the Spider

Spider discharges it thro' one or more Orifices, the Thread lengthens in proportion to her distance from the Place where she first fasten'd it. When she closes the Apertures of her Dugs, the Threads no longer lengthen, and she remains suspended in the Air. She afterwards makes use of this Thread for her Ascent, by grasping it in her Paws, as some People climb up a Rope with their Hands and Knees. With this Thread she spins a Web that furnishes her with Advantages of a very different Nature. I shall now describe its Texture and Use.

When an House Spider intends to begin a Web, she first chuses a Place that has some Recess, as the Corner of a Chamber or a Piece of Furniture, into which she may retreat under her Web, and secure herself a Passage either upwards or downwards, and by this means accomplish her Escape from any Danger that may occur ; she sheds upon the Wall a little Drop of her Gum, which immediately sticks to it. The Spider then lets the Liquor distil thro' a smaller Orifice. Her Thread lengthens from her Rear whilst she proceeds from the side, as far as the Place to which she designs to extend her Web. The Thread is fasten'd to one of her Spurs, for

The Web
of an
House-
Spider.

for fear it should fix along the Wall whilst her Intention is, that it should only traverse the Air. When she arrived at the Point to which she purposed to continue her Web from the opposite side, she there fastens this first Thread by the help of the Glew; she afterwards draws it to her, first bending and then stretching it tight. Close to this Thread she fixes another, which she carries forward by running along the first, like a Vaulter on his Rope. She proceeds to glew the second Thread on one side of the Point where she began her Work. The two first Threads assist her like a Scaffold, to build the rest. In this manner she passes and repasses several times, connecting or separating her Threads as she judges convenient; she stretches and binds them all one after another with the same Industry. Thus the first Range of Threads is hung, and we may call this the Warp.

Chev. I understand you; she will presently begin to spin her Threads transversely, and that will make the Woof.

Prior. Perfectly just; but the Work of a Spider differs from those we wear in this Circumstance, that in our Woof the Threads extended in Length are interlaced

placed with those that are carried on transversely, whereas the Threads of a Spider's Woof only cross the Threads of the Warp, and are glewed to them at the Points where they mutually touch, and are not inserted or interwoven. After this the Spider doubles and trebles the Threads that bordered her Work, opening all her Dugs at once, and drawing several Threads over one another. She is sensible that the Extremity of her Web ought to be hemmed and fortified, to preserve it from being torn; she likewise further secures and supports it with strong Loops, or double Threads, which she fixes all around and which hinder it from being the Sport of the Winds.

Cher. This is a Work that certainly deserves our Admiration; but I shall have a real Pleasure to see the Structure of the Lodge where she lies in Amplecad.

Prior. The Spider is well acquainted ^{Her} with herself, and conscious that if she ^{Lodge.} makes her Appearance she shall intimidate her Prey; and therefore, at the Bottom of her Web, she contrives a little Lodge, where she keeps Centry un-; the two Outlets, one above and the other below, with which it is accommodated, give her an Opportunity of

of being every where when necessary and of visiting and cleaning all Parts.

From time to time she clears away the Dust that would otherwise be too incommodious to her Web, and sweeps the whole by giving it a Shake with a Stroke of her Paw ; but she considers what she is about, and so nicely proportions the Force of her Blow that she never breaks any thing.

From all parts of the Web are drawn several Threads, that terminate like Rays in the Center, where she retires and keeps her Watch. The Sound made by the Vibration of one of these Threads is communicated to her, and gives her notice that there is Game in her Net, and accordingly she springs upon it in an Instant. She derives another Advantage from this Retreat under her Web, and that is, the Opportunity it affords her of feasting on her Prey in full Security, besides concealing the Carcasses, and not leaving in the Place any Traces of her Barbarity capable of intimating the Place of her Resort, and inspiring Insects with an Ambition to approach it.

Chev. I would willingly know, Sir, how Spiders are always supplied with Materials for Spinning ; for People torment them exceedingly, and yet

and their Work repaired the next day.

Prior. That Providence which knows the Spider is hated, that her Labours create her many Enemies, and that her Web is always in danger of being disconcerted, has furnished her with a Magazine for frequent Repairs, and this Magazine, after it has been exhausted, is still replenished with fresh Recruits; however, this Reservoir is drained in time. When they grow old, both the Ham and Sponges in their Feet, are tied up.

Chev. How do they live then, in that condition?

Prior. They use Industry: An old Spider, who has no longer any thing to subsist on, seeks out a young one, and acquaints it with her Necessities and Attention; at which the other, out of respect to old Age, or Apprehension of the Pincers, resigns its Place to her, and makes itself a new Web in another Situation. But if the old Spider can find none of its Species that will, either by consent or Compulsion, resign its Nets to her, she must then perish for want of Subsistence.

Countess. The *Prior* has not yet entirely reconciled me to this Animal; but he has cured me, for some time, of

Garden
Spiders.

of the Aversion I had to hear it so much as mentioned. Nay, I have proceeded farther ; for I have observed, as well as I was able, the Work of a Garden Spider, and find it very different. As her Labour has appeared to me to be very peculiar, I have a Mind to give the *Chevalier* some Account of it. There are many People who believe she flies, when they see her pass from Branch to Branch, and even from one Tree to another ; but she transports herself in this manner : She places herself upon the End of a Branch, or some other projecting Body, and then fastens her Thread ; after which, with her two hind Feet, she squeezes her Dugs, and presses out one or more Threads of two or three Ells in Length, which she leaves floating in the Air. These Threads are wafted by the Wind from one side to another, and lodge either on a House, or a Pole ; sometimes on a Tree, or Stake cross a Brook ; and are there fasten'd by the natural Glew : She afterwards draws them to her, to try if they are well fixed or not, and then they become a Bridge, over which the Spider passes and repasses in full Liberty. She doubles and extends the Thread as much as she thinks fit, by joining the short

os together ; and then marches over
third part, or to the middle of the
ne Thread, and adds another to it,
m which she precipitates herself,
she meets with a Stone, a Plant,
some solid Body to rest on, or
e she leaves it to float in the Air
in, till it is fixed to some particu-
Place. By this second Thread she
ends to the first, and at some dis-
ce begins a third, which she fastens
the same Management. When she
fixed three Threads, she makes
m stronger by doubling them ; after
ich she endeavours to project a kind
Square within them, which is easy
her to accomplish, because she as-
ds by the Thread which joins on
Right-hand to that which is above,
d from thence she passes to the other
ich descends on the Left. During
this Progress she continually Spins,
d then shortens and bends the Thread
ich falls from the Right-hand, and
ns it to that on the Left, in what part
is best pleased with ; and by this
ans forms a Square, or some Figure
at resembles it. In this Square she
akes a Cross, with the same Industry,
ose middle Point becomes a Center,
which she draws Threads from
ch Side, like the Spokes of a Wheel,
I which

which all terminate in the Middle. This is the Warp or Basis of the Woof. She then spins a finer Thread for the Woof, placing herself in the Centre where all the Threads of the Warp cross one another, and round this Center she draws a small Circle; after which she begins another a little more distant, and always continues to draw this circular Thread from one Spot to another till she comes to the last Threads that sustain the whole Woof. When the Net is thus spread, her next Care is to entrap the Game; for which Purpose she places herself in the Center of all these Circles, with her Head downwards; because her Belly, which joins to a very slender Neck, would fatigue her too much in any other Situation; whereas, in her present Posture, her Belly is supported by her Feet and Breast. In this Station she awaits her Prey, which she is not long destitute of, for the Air is so replenished with Flies who are perpetually in Motion that a sufficient Quantity of them soon fall into her Toils. When a small Fly becomes her Captive, she dispatches it upon the Spot, because it is a Repast that does not require much Preparation; but when her Provision is larger, it happens to be a strong Fly that ma

vigorous Resistance, the Spider involves him in a Number of Threads wheeling round him, in which she angles and fetters him, and keeps him suspended by her Thread; after which she bears him away to the Nest above her Web, and which she conceals under the Leaves, or under a Tile, or some other commodious Shelter, either to pass the Night in, or screen herself from the Rain.

Cher. But this Work must be very little, Madam, and liable to be carried away by the least Wind.

Countess. The Wind is not so injurious to it as you imagine, for the Web is very penetrable, and the Wind flies thro' and seldom disorders it: That infects them most is the Rain; and as the Tissue of their Web is very thin and transparent, the Expence is considerable, and they have always Materials for a new Net when they want it. This, Sir, is what I know of Garden Spiders; and I may add, that I have lately made these Discoveries, after I had parted from you: I pursued the Spider thro' all the Allies and Avenues, with purpose to do you a piece of Serenade. As to the Spiders that harbour in the Walls, you will excuse me if I can give you no Account of them.

The Black
Spider.

Prior. This Animal contents herself with distributing her Threads about the adjacent Parts of her little Cavern, and forms a small Avenue in the Centre to accommodate herself with a free Passage. When an Insect flies about these Territories, it never fails to move one of those Threads which are projected all around, like so many Rays. The Spider, at this Intimation, immediately quits her Ambuscade. She is more malignant than any other Species of these Creatures; if you seize her without the Assistance of two little Sticks, or any other manner, she bites the Instrument that holds her. She is also much better fortified than other Spiders; and the Wasp, for Instance, who by his Sting and repulsive Armour so embarrasses the rest, never intimidates her. The Black Spider is not to be penetrated by this Sting; on the contrary she crushes the Bones and Scales of the Wasp with her Pincers.

I shall bestow but a very few Words on the wandering Spider, and the Spider, or Field Spider.

The wandering
Spider.

The Wanderers are of several Species and various Colours, they generally creep and leap; and as they are not stocked with Thread enough either to entangle their Prey when they want it, or to

er the Wings of the Fly which in-
mode them, Nature has fixed in their
fore Paws, which we shall call
ir Arms, two Tufts of Feathers,
h which they stop the Fluttering and
tation of their Adversaries Wings.
ere is another Species, not so large as
of a blacker Complexion, and
re singular than the rest; and who,
he Months of *September* and *October*,
end their Threads along the Grass
Meadows, or over the Straw that
ains after the Harvest. She like-
e abandons several of these Threads
he Wind, which bears them away.
ey frequently fill the very Air, and
e, lengthen, and fix on every
e. The Spiders who meet with
Thread fasten themselves to it,
dart as if they had Wings, to the
s of Towers and the loftiest Build-

ountess. You present us with a true
ure of great Prosperity, for the At-
ment of which a Thread must first
ound, that may guide to such a
ation. When this is acquired, the
effor is exalted, but then he hangs
single Thread. Be pleased now
come to the Spinner, or Field
er.

The Field
Spider.

Prior. Nothing is more remarkable in this Creature, than the extreme Length and Delicacy of its Legs. As she is destined to live amongst the smallest Herbage of the Field, the minutest Leaf would stop her, were she unprovided with these extended Legs, that raise her above the common Verdure, and enable her to pursue her Prey with due Expedition.

The Eggs
of Spiders.

But it is not sufficient to have given you a Description of the several Kind of Spiders, or at least those that are most common; it will be an additional Satisfaction to you to know how they arrange their Eggs, and preserve their Species *. Several People never eat Fruit because they believe Spiders and other Insects scatter their Eggs upon it at random; but there is not the least Cause for this Apprehension. There is more Preparation and Care bestowed on these Eggs than is generally imagined, and so far from abandoning them to Chance, the Spiders spin, for their Reception, a Web five times stronger than that wherein they catch Flies. To this Web they work upon with Pleasure, and to which they appropriate the best Materials the Profession can furnish. With this Web they make

* Memoirs de l'Acad. des Sc. M. de Reaumur 1710.

Bag, wherein they deposite their Eggs, and it is incredible to think what Care and Labour they employ for the Preservation of that Bag.

Chev. Such a Bag as this makes me laugh heartily ; but can't you oblige me with the Sight of it ?

Prior. 'Tis good not to be too credulous : But, if her Ladyship pleases, we will walk a Moment by the Box-Trees that border this Terrace : I have, before hand, been searching upon your Account, and have found what you desire to see. Observe in that Box-Tree, one of these Spiders who never spin a regular Web, like others. Under her she carries a large white Ball, which you would judge to be part of her Body.

Chev. And is it not her Belly ?

Prior. Nothing less. Take a Twig and shake the Spider a little, to make her drop the Ball.

Chev. 'Tis fallen down, and the Spider runs after it.

Prior. This is the Bag you was desirous to see : Don't think the Dam will forsake it : Pray observe her Behaviour.

Chev. I see her roll herself over the Ball.

Prior. She does more, for she forces out of her Dugs a clammy Liquor, with which she fastens herself a-new to it.

Chev. 'Tis very true, and see how she carries it away with her.

Prior. She will not stop here : Her Tenderneſs for her Young will diſcover itſelf by many other Solicitudes. Judge of them by this other Spider, who is of the ſame Species, and whoſe Young are hatched.

Chev. Where are they : I only ſee the Dam.

Prior. Obſerve what ſhe has on her Back.

Chev. All that I can diſcover, is ſomething prominent.

Prior. Move gently ſome of the Threads you ſee ſcattered here and there in that Opening, and obſerve what will come out at the Top of the Creature.

Chev. Bleſs me, what a pleaſant Sight is here ! To my thinking I ſee above a thouſand little Spiders ſkipping down from their Mother, and running along all the Threads : Does ſhe carry the whole Family on her Back ? What will become of them now ?

Prior.

Prior. Stand still a little : When the Danger is once over you'll see all the Family come together again.

Chev. And there they are indeed, all assembled in a little Ball upon their Mother's Shoulders.

Prior. Here is a Spider of another Species, who lays up her Eggs in a Purse made like a leathern Cap, which she sometimes fixes on a Wall, and sometimes on a Leaf, as she has done here : She never loses Sight of this precious Deposite ; but continues whole Days and Nights near it : She hatches and warms her Eggs by constantly brooding over them. Pluck off the Leaf, and see what will become of the Dam.

Chev. She suffers herself to be carried away with the Leaf ; I am not very fond of such a Neighbour.

Prior. You may kill her sooner than force her to abandon her Brood : She never quits her Hold till the little Spiders are hatched. But tell me, Sir, what you see in that other Opening.

Chev. I perceive two little Bags or Packets of a reddish Colour, suspended by a couple of Threads ; and before these Bags I see a Pendant of dry Leaves. For what Use are these things intended?

Is

Is not this Work accidentally formed by the Wind?

Prior. 'Tis a Spider of another Kind who has there hung up those two Bags, wherein she has treasured her Eggs.

Chev. But what may be the Use of this Bunch of dry Leaves, that swings about in the Entrance?

Prior. 'Tis to deceive Passengers, and especially Wasps and Birds, who are upon the Watch for the Bag of Eggs. This little Whisp of dry and redish Leaves is no proper Morsel for the Birds; and then, by its perpetual Agitation, it hinders them from discovering the Packets that are hid behind.

Chev. Prosperity to the Industrious!

Prior. We will not look for any common Spider to give you an Insight into her particular Qualities; it is sufficient to acquaint you, after what you have seen, that in general all Spiders wrap their Eggs in a Web whose Strength is astonishing. They commonly fasten the Packet to a Wall. When any Danger appears, their first Care is to pull down this Packet, and with it to save themselves where they can. Thus, my dear *Chevalier*, you have my Observations on Spiders, and the several Species you have seen are all that I have any Knowledge of.

Countess. We must have a word or two on the Tarantula, the Species is too extraordinary for us to forget it: This Animal very much resembles House-Spiders, but the Bite of it, especially in hot Countries, produces very fatal and astonishing Effects. The Poison is not immediately perceptible, because its Quantity is too inconsiderable*; but then it ferments, and occasions very frightful Disorders five or six Months afterwards. The Person that has been bitten, does nothing but laugh and dance, is all Agitation, and assumes a Gaiety full of Extravagance, or else is seized with a black and dismal Melancholy. At the Return of that Period of the Summer Season when the Bite was given, the Madness is renewed, and the distemper'd Party constantly talks over the same Inconsistencies, fancies himself a King, a Shepherd, or indeed any thing you please, and has no regular Train of Reasoning. These unhappy Symptoms are sometimes repeated many Years successively, and at last end in Death. Those who have been in *Italy* †, about *Naples*, tell us, that this odd Malady is cured by a Remedy altogether as odd; for, according to them, nothing but

* *Memoirs de l'Academ. des Scienc.* 1708.

† *Mission's Voyage into Italy.*

Musick,

Musick, and especially an agreeable and sprightly Instrument like a Violin, can give Relief; for which Reason they are never without such in this Country. The Musician endeavours to find out a Tone that seems to bear some Proportion to the Temperament and Disposition of the Patient: He repeats his Attempt, and if he touches a Note that makes an Impression on the distemper'd Person, the Cure is infallible: The Patient immediately begins to dance, and always rises and falls according to the Modulation of the Air. In this manner he continues till he has heated himself into a Sweat, which drains off the Venom that torments him, and at last gives him effectual Relief. I had this Account from a Friend of ours who has been Consul for the *French* Nation at *Naples*, where, he assured me, he had seen Instances of People who were bitten, and cured in this manner.

Chev. I find Learning shines thro' all this Family, and every thing I hear in this Place is agreeable, and extraordinary.

Countess. You will certainly be surprized, and tell me I am very learned, when I shall discourse with you about my little Chickens, and all the Wonders of my Poultry, for that Subject

ject will come in its Turn.——
But I see the Count alighting from his
Horse, and he has brought home a-
bundance of Company. Let us go and
receive him.

Cher. I fly to embrace him.

The End of the Fourth DIALOGUE.

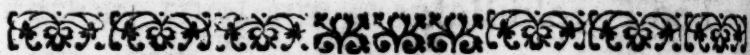
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W A S P S.



W A S P S.



DIALOGUE V.

The Prior de JONVAL.

The Chevalier du BREUIL.

Prior.



SIR, the Company that came here Yesterday have some Affairs to dispatch before they go, and neither the Count nor his Lady will be able to wait on you To-day. As for my Part I shall make you but indifferent Amends for this Loss; but I have a Piece of News to tell you, that perhaps may amuse you.

Chev. What may that be, Sir?

Prior. Something has been just now discovered under Ground that deserves

you

your Curiosity the most of any thing in the World.

Chev. Is it to be seen ?

Prior. It is, and this very Day too.

—The Affair, in short, is this. The Count desired me to entertain you this Afternoon with the Changes that happen to Flies of every Species. I employed myself, Yesterday, in preparing a full Account for you of all that can be said on this Subject, and was digesting my Remarks in a little Order, when a Person came to acquaint me, that some Husbandmen who were at work in our Neighbourhood, had found a Curiosity that had filled Numbers who came to see it with Admiration. Upon this I immediately left your Metamorphoses, and went, like other People, to take a View of it, and really the thing deserved it ; for they had found an entire City buried in the Earth, and such a City as was capable of lodging between eleven and twelve thousand Inhabitants. The Structure of this City was perfectly ingenious, tho very different from ours : The Wall is not a simple Inclosure surrounding the Place, but a great Vault, that intirely covers and encompasses it on every part. After they had carefully surveyed it, they could only discover two Gates ; and

as the Darknefs was very great under this Dome, they had demolished part of it to have a clear Prospect into the different Quarters of the City. But here another Scene of Astonishment opened : The Streets are not ranged like ours, in Side Lines, but piled over each other in different Stories, which are separated by several Ranks of Columns ; so that they are rather Porticos than Streets ; the uppermost of which rises on the second, the second on the third, and so in Succession, reckoning downwards. All the Houses are of equal Dimensions, and thick set against one another in the Substance of the Vaults. Those which compose one and the same Order, are all on a Level in each Story, and covered with a Terrace or common Roof quite flat made with a very binding Gum, and as smooth as an Apartment paved with Marble. Here the Inhabitants walk between the Pillars that support another Vault with its Range of Houses. There are eleven of these Porticos or Vaults, all of the same Structure, and raised with the nicest Symmetry and Correctness of Design : 'Tis the Obscurity alone that disfigures the Work ; I did not so much as see the Remains of any Lanthorn,

other Contrivance, to illuminate the City.

Chev. A very strange Place to live in, surely.

Prior. You believe, Sir, that I am describing to you some City that was built before the Flood, and afterwards remained buried under Ground.

Chev. I don't know what to think.

Prior. Indeed 'tis a very surprizing Affair; for this City was built by a Swarm of Wasps.

Chev. How! Is it no more than that?

Prior. No more than that? ———

If this City had even been built by Men, there would have been no Occasion to exclaim against it; but it is altogether astonishing, that a grand Dome, with Porticos and Columns; in a word, that an intire City should be founded by Wasps.

Chev. Let us see this Nest of Wasps then: We shall be diverted with it.

Prior. It is in that Arbour, and I imagined it would be more entertaining to you than a serious Dissertation on Insects. I have preserved it almost intire, for there is only a little Hole made in one of the Sides, to give one a View of what is within. Step in, and look at

K

it:

it: You will find the whole City placed on a Bench.

Chev. Oh! Sir, what a delightful Work is here! I see every thing as you have represented it. Here are the Pillars, the Stories, Houses, and Cupola. But how could you get this Nest, and where was it found?

Prior. I perceived the Number of my Bees and my Quantity of Honey sensibly diminished, and suspected that some Wasps Nest in the Neighbourhood was the Source of this Mischief; and accordingly I ordered it to be destroyed, if it could be found. It was discovered at last, and Yesterday, in the Evening, they stormed it with Sword, Fire, and Sulphur. When they had begun to open the Ground at the Wasps Hole, in order to force them out, and burn them in their Passage, I was told they had found a large Pannier, made almost like a Gourd. I knew what it was, and immediately determined to preserve it that you might have a Sight of it. This is the City then, that I have been describing: But no more of the Terms City, Colonnades and Architecture. Let us talk of things simply as they are: there is still enough of the Marvellous to charm you, I speak of the Marvellous unmixed with Falshood; that Marvellous

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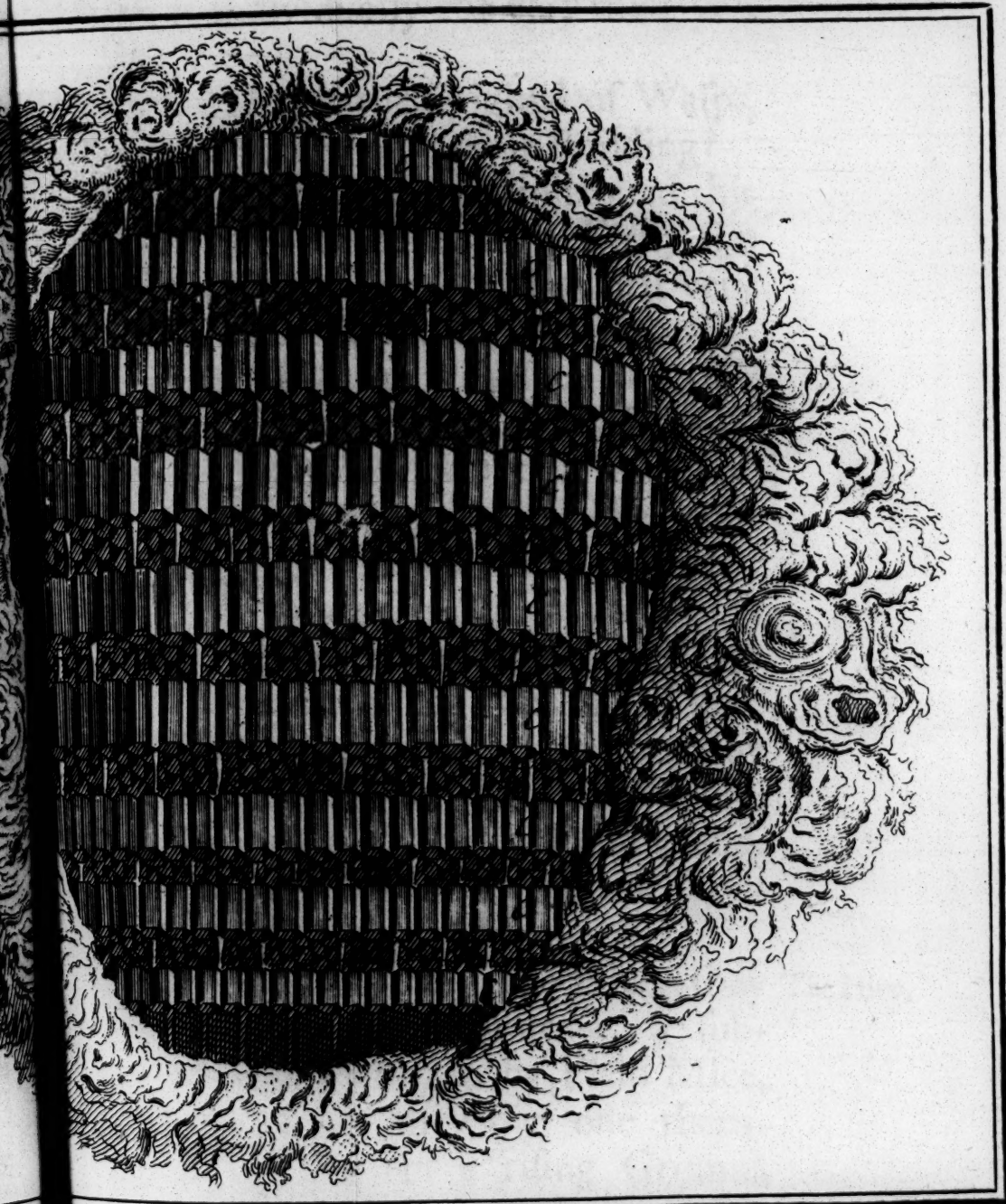
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Part 1.st Page. 130.



A. Motte Sculp.

A. The Wasps Nest B. To put in
rate them E. The various Sp.



B. The Outward Covering C. The Comb D. The Columns which Sepe-
 rate the Space between the Cells of the Combs.



vellous which good Sense demands, and which is individually the very thing you love.

Chev. What is the Original of Wasps, and how do they raise their Building?

Prior. The Wasps who inhabited this Pannier are of three sorts *: First, the Females who are large, and at first very inconsiderable in Number; secondly, the Males, who are almost as big, but more numerous; thirdly, the Mules (if I may so express myself) that is to say, Wasps who are consigned to the most laborious Employments, and are neither Males nor Females: These are much smaller, but vastly numerous, and are the Commonalty of the Nation. There are three sorts of Labours that employ Wasps: First, the building of the Nest; secondly, the providing of Food; and, thirdly, the laying of Eggs, and Nourishment of their Young.

As to the Structure of the Hive, they The Hive. first chuse, about Midsummer, a subterranean Cavity begun by Field Mice, or Moles, or else they dig one themselves, and always in a rising Ground, that the Water may flow down below their Place of Residence, and not be incommodious to them. When they

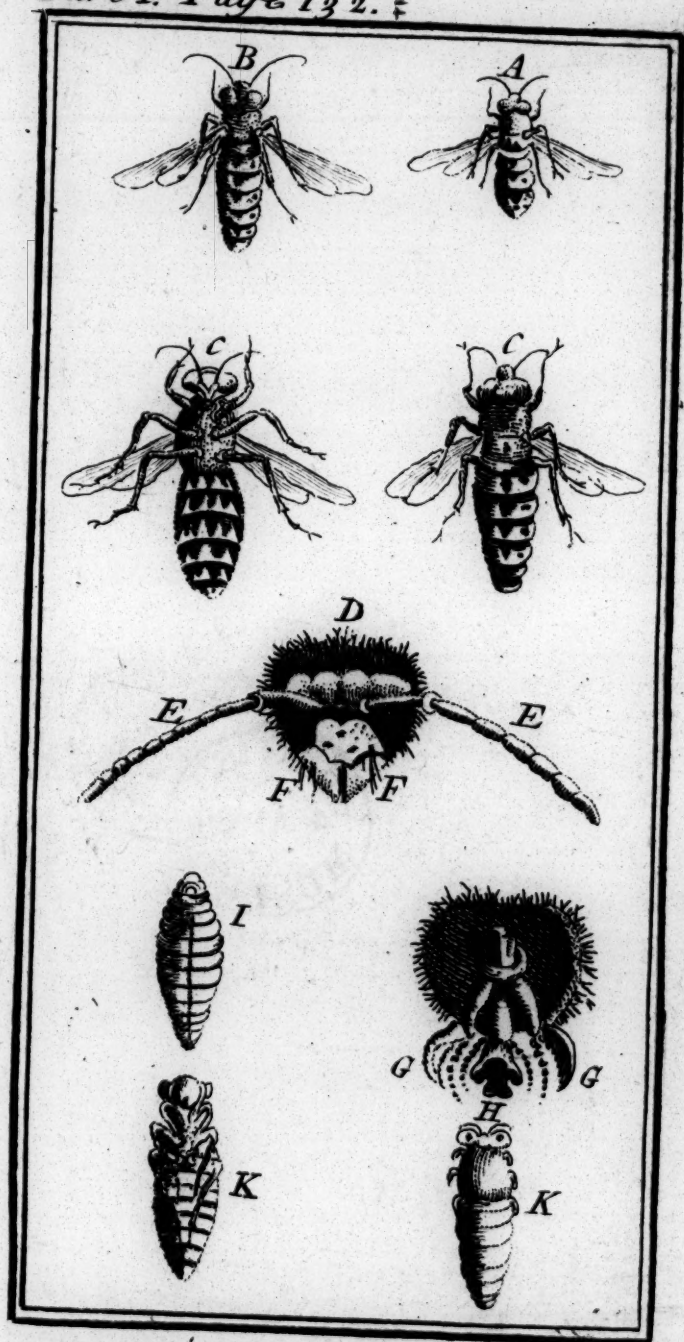
* Memoirs de l'Acad. des Scienc. M. de Reaumur. 1719.

have chosen a Situation, they begin to work with amazing Industry ; they scoop out the Earth, and even carry it to some distance. Their Activity must be very great, since in the Space of a few Days they build under Ground an Habitation above a Foot high, and as much in Length as well as Breadth. Whilst some are digging, others are in the Fields, seeking Materials for the Edifice. In Proportion to their casting out the Earth they strengthen the Roof, and prevent its falling in by cementing it with Glew ; they then affix to it the Foundation of their Building, which they continue to finish downwards, as if they would make a Bell, and close it at the Bottom.

Chev. How are they able to remove and throw out the Earth ? I can hardly comprehend that Flies should be capable to sink themselves a Dwelling so deep.

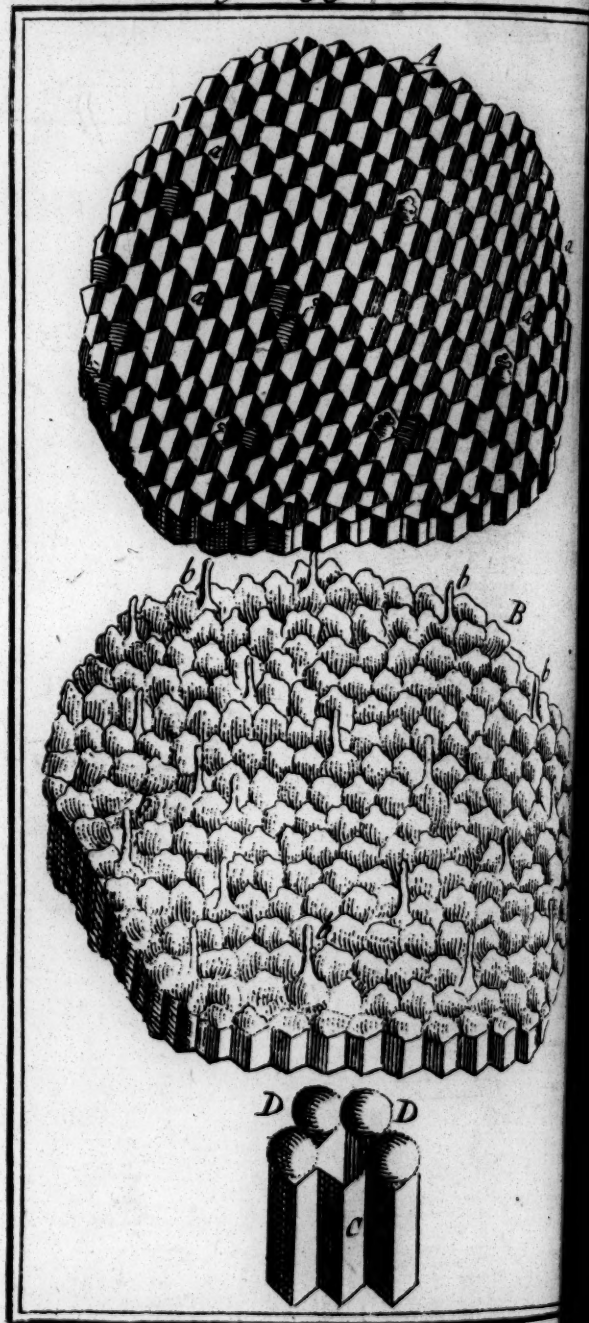
Their
Tools.

Prior. They are provided with excellent Tools for that Purpose : Out of their Mouth a Trunk extends, near which are two little Saws that play against each other to the Right and Left. Besides these they have two large Horns and six Feet. I don't know whether they employ their Trunk or not, upon this Occasion ; but they cut the Earth into









A. A nether View of a Wasps Comb. (a) the Apertures of the Cells. B. an upper View of the Comb. the Columns that separate the Combs into different Quarters. C. an open Cell. D. Cells closed up.

into little Particles with their Saws, and carry it away with their Feet.

Chev. I have a particular Curiosity to know of what Materials this Building is composed.

Prior. They are only Wood, and The Materials of the Nest. Glew: The Mule Wasps are dispatched to cut Wood out of the Frames of Windows, the Lattices of Arbours, and the Extremities of the Roofs of Houses; they saw and carry off a Multitude of little Shivers; and when they have hacked them very small, they amass little Heaps with their Paws, and pour in a few Drops of a glutinous Liquor; by the Aid of which they knead the whole into a Paste, and then round it into a Ball. At their Return home they place the Ball upon that Part of the Building which they would either lengthen, or make thicker: They spread it out with their Trunk and Paws, going backward all the Way. When the Bowl is reduced to a level Surface, the Wasp returns to his first Stand where he began to spread the Paste. He then presses and spreads it a-new, and always with a retrograde Motion of the Body, till he arrives at the opposite Side; and when he has repeated this Operation two or three times, this pliable Composition of Wood and Glew becomes a small Leaf,

The manner of Building it.

of a Grey Colour ; but so exceeding thin, that the finest of our Paper is not at all comparable to it. The Mule Wasp having completed this first Bowl, returns to the Fields for more, which he still works into Leaves, and lays them one over another. Others of his fellow Labourers place new ones on the former, and all these Leaves thus joined and cemented with the same Glew, form the grand Cupola that bends over and covers the whole Habitation. The Cells and Columns are made with the same Materials.

Chev. If I can judge by my Touch, the Columns are extremely hard, and much more so than the Dome.

The Columns.

Prior. Your Observation is just ; and it is very certain they are particularly careful to harden the Columns. I don't know whether the Matter is more compact and tenacious, or whether they cement it with a larger Quantity of Glew ; but it is very natural, that what sustains the Pile should have the most Solidity.

Chev. Can you acquaint me, Sir, whether these little Pillars have larger Dimensions in the two Extremes, where they touch the upper and lower Stories ?

Prior. The Materials are spared with a prudent Frugality in the Shaft of the Pillars.

Pillar, but it could neither support itself on its Basis, nor sustain its Architecture, without being well fixed and glewed at the Points of Contact. 'Tis for this Reason the two Extremities were swelled, that they might cover a larger Surface, as it is certain that a greater Circumference of Glew has a more serviceable Effect at the Bottom and Top, I had almost said the Base and Capital.

Chev. There is a great deal of Judgment in all this: But what is the Meaning of these two Openings?

Prior. One is a Passage into the Edifice, and the other leads out of it: thro' the first of these such Wasps enter who are charged with Burdens; those that are going to the Fields, pass out at the other. By this means they have no Interruption in their Motions.

The Doors.

Chev. I see they have a free Passage under these different Stories, and may enter into which House they please. All the Doors of these Houses are open below, except some that, I observe, are closed up with a sort of Parchment: But here are several others too, that I find shut in the same manner.

The Stories.

Prior. I will acquaint you with the Reason of this in a few Words; but first I desire you would count the Stories

that you see raised one above another, like so many Cakes.

Chev. I find eleven of them ; but this at the Top is very small, and so is that at the Bottom ; and they grow larger towards the Middle of the Pannier.

The Cells.

Prior. The most remarkable Circumstance is, that one should see whole Cakes composed of spacious Apartments, and others parcelled out into such as are very scanty. The large Cells are appropriated to receive the Eggs that are to produce Males and Females ; the narrow Lodges are to contain the Eggs out of which the Mule-Wasps, who are by much the smallest, are to proceed. Our Architects are not mistaken in their Proportions, and the Mothers of Families never deposite in a Mule-Wasp's Lodge, any Egg, impregnated with a Male or Female. The Lodges of the Mule-Wasps, are between seven and eight-twelfths of an Inch in length, and about three-twelfths of an Inch, or more, in breadth ; the Columns may be six-twelfths of an Inch in height.

Chev. I discover thirty-nine or forty Columns, between one Story and another.

Prior. You will sometimes find more but at present observe the Regularity of the

the Cells; they are all Hexagonal, which, in every Respect, is the most commodious Figure for a Range of Cells, where there are no Vacuities; were they round, they would only touch one another in a single Point, and the void Interval would have been quite lost; had they been triangular or square, they might certainly have been very well connected together; but then the Angles within would have been lost, because the Animal for whose Habitation it is intended, is round. Hexagons approach the nearest to a circular Figure, and have all their Sides exactly adhering to each other, so that there is no useless or unnecessary Vacancy between them; and every Lodge, weak as it is, becomes fixed and solid by its Union with others.

Chev. Believe me, Sir, the finest Palace would not strike me so much as the Regularity of these little Apartments: but let us now proceed to the Food of Wasps, for I see you are perfectly acquainted with all that passes in this little Nation.

Prior. I forgive them all the Injuries ever received from them, and the Honey they have robbed me of, for the sake of the Pleasure I have had in studying their manner of subsisting.
They

They love to lodge themselves in the Neighbourhood of Bees, Vineyards, and the best Garden Vines, and have a particular Fondness for a Kitchen; there they meet with Provisions ready prepared. The Mule-Wasps, and even the Males, range the Fields for Prey; they expatiate every where with Intrepidity, and venture into the very Hives of Bees, who are sometimes much embarrass'd to defend themselves from their Invasions. When there is no Honey to be got they fall upon the best Fruits, and are never mistaken in their Choice: The Apricot, for Instance, is very palatable to them; 'tis the same with the Bon Chretien, and other delicate Pears; the ruddiest Peaches and the ripest Grapes, especially the Muscadine, are their usual Food, according to the Season; but for all this they are not over dainty, for at other times they can submit to any Diet. Nothing comes amiss to them in a Kitchen; they can take up with Fowl, Bacon, or even Butcher's Meat, and are not so nice as to despise any thing. If they light on a Butcher's Shop in their Way, they immediately look to the material Point, and have no Thoughts of proceeding farther: Here they fall to work, and carry off Bits of Flesh half as big

themselves, to their Nest, where the Females distribute the Provision among their little Offspring. The Butchers, who have Discretion enough to understand their own Interest, accommodate the Matter with them, and very regularly present them with a Piece of Neat's or Calf's Liver. This they fasten upon preferably to any other Food that has Fibres, which are too long and difficult for them to cut thro'. But it is not only to divert them from other Meat, that the Butchers compound the Matter with them at this Expence; they derive a great Advantage from this Proceeding, and are not at all dissatisfied with the Visits they receive from the Wasps; for whilst these Creatures are regaling themselves with the Liver, there is no reason to fear that any Fly, or other Insect, will approach the Place, and make Depredations on the Meat, because the Wasps keep Company, and chase them without giving any Quarter; and the Fly would be very daring that should then presume to make its Appearance: The worst that can happen is, that the Wasps may here and there mangle some other Provisions at their own Discretion, but the inconvenience is not very considerable, because this Animal defiles nothing, the
Female

Female always confining herself to the Hive with her Eggs; whereas the Fly is very sedulous to lay her Eggs in some Piece of Meat or other, which is very prejudicial to the Butchers.

Chev. I am extremely pleased with Wasps, and perceive they are very ingenious Creatures.]

Prior. I find their Industry and Neatness make you prejudiced in their Favour, but I must tell you the whole Truth : They destroy all the Merit of these Qualities, by others that are very pernicious. They are exceedingly rapacious and cruel, and, if I may use the Expression, are mere Pirates and Cannibals to the Nation of Bees ; not satisfied with stealing Honey, they murder the very Bees ; they seize, they crush, they kill, nay they even devour their Enemies : This is far from being an amiable Behaviour. But, without excusing them, I may venture to say, that in these Particulars they resemble great Numbers of our own Species, and even our *Europeans* themselves. The Wasps plunder and devour other Flies. 'Tis the very same with us : How many Men are Wasps, in the highest degree, with respect to their fellow Creatures ? The Difference is, that Wasps are voracious by a natural Instinct that impels them ;

Of INSECTS.

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them; whereas Man is a Malefactor by Choice, and in opposition to the Dictates of Reason that enlighten him. We may add, that the Necessity Wasps are under of constantly providing for a numerous Family, in some measure, excuses their Avidity. But to proceed: The Distribution of the Food is made with a great deal of Exactness; the Mothers are charged with this Care, and are sometimes assisted by the Mule-Wasps.

The first thing discoverable at the bottom of each Cell, is a little Egg fasten'd with a viscous Substance, to preserve it from falling. Into this Cell we may see the Dam frequently enter, who apparently communicates a genial Warmth to the Egg, in order to facilitate the Birth. From this Egg proceeds a little Worm, which the Parent carefully nourishes, and which by degrees increases in Bulk, and thrives very successfully, filling the whole Apartment with the Roundness of its Form. The Mother, after she has received and provided the Provision brought to her by the Mules, goes from Chamber to Chamber, distributing Portions of it with her Mouth to each Worm in its turn, and all this with the greatest equality, except only that her Supplies are

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are more frequently imparted to the large Worms, who are to produce the Males and Females. Turn up the Hive, Sir, and look into the Entrance of these Cells. — What do you discover there?

Chev. I see the large Worms you mention. Here is one that opens its Mouth, and takes my Finger for its Dam.

Prior. He has been neglected ever since Yesterday, and without doubt has a pretty good Appetite.

Chev. But a great many of the Cells are stopped up.

The
Nymphs.

Prior. The Affair is this: All these Worms, after a certain Period, cease to be burdensom to their Mothers. They leave off eating, and will receive no more Sustenance. 'Tis then they begin to employ their Mouths in Spinning a very fine Silk, one End of which they glew to the Opening into their Apartment, and then winding their Head from side to side, they fasten it to different Places; and by Vertue of their repeated Motions, form with the Silk that continually lengthens, a kind of light Stuff, that serves to close up the Passage. In this Retirement they divest themselves of their Skin, the Worm dies, her Spoils fall to the Bottom of the Cell, and nothing now remains but

Whi

White *Nymph*, who gradually disengages her Feet and Wings, and insensibly acquires the Form and Complexion of a perfect Wasp. Break some of these Partitions, and you will see her as it were, swaddled up, and only exhibiting to View an imperfect Sketch of the delicate Limbs of the succeeding Animal, who gently fortifies himself in the little Mansion that protects him from Danger, till his Feet are all unfolded and then he breaks thro' the Partition that shut him up. I am now going to shew you this : Here, Sir, is a Worm changed into a *Nymph*.

Chev. What an agreeable Figure it makes with its extended Chin bending back, and its Paws join'd together?

Prior. Some Insects continue whole Years in this State of *Nymphs*, but the Wasp is not confined to it above twelve or fifteen Days at most ; after which, finding himself equipped with all his Furniture, he demolishes the Door of his Cell. You may then see him extend, first one Horn, and then another ; to these a Paw succeeds, the Head grows visible next, and the Aperture widens with the Efforts of the Insect's Body, till at last he comes out a complete Wasp ; whose first Employment is to wipe off the Humidity of his little Wings with

with his hind Feet, that brush them for some time ; after which he springs immediately into the Air, and flies to the Fields to pillage with the rest of his Species, whose Address and Malignity he begins to imitate from that Day.

Chev. How ! without any Apprenticeship ?

Prior. Most certainly. — As for the Mule-Wasp, it falls to plundering the Moment it leaves its Retreat. The Male, when he quits his, passes away some time in sporting, and then goes to make his court to the Queen of that Quarter. But as soon as ever the Female makes her Appearance, she is busied with the Management of her Family.

Chev. I find the Mother has a very agreeable time of it in this Country, but I can't help pitying the poor Mule who are charged with the Weight and Fatigue of all the Work.

Prior. It's true, the Mothers are well treated ; they have the best of the Provisions, and are served with the greatest Affiduity and Respect. Nothing can equal the Politeness of their Conduct, and indeed of the whole Tribe. But then the Number of these Mothers is very inconsiderable, and they have a prodigious Family to manage. Wh

you consider the Quantity of Eggs they are to lay, the Multitude of Young they must nourish, the Necessity they are under of perpetually going from Cell to Cell, and from one Story to another, to visit and give Satisfaction to each Individual ; to be eternally repeating the same Labour, and what is worse, to be constantly confined at Home, I say, when you consider all this, you will agree that a Mother-Wasp is in a very indifferent Situation. As for the Mules you are so compassionate to, their Condition is much more eligible ; they wing the Air in quest of Food, they village, they eat, they sleep without the least Anxiety, and are certainly the happiest of all the Clan.

Chev. Do the Wasps, Sir, make any provision for the Winter ?

Prior. They don't so much as *take thought for the Morrow.*

Chev. How are they able then to pass that long and uncomfortable Season ?

Prior. At the Approach of Winter, every thing changes in this Republick : When the first Colds begin to be felt, the Females and their Consorts, who all then were so tenderly affected towards their Young, destroy the whole offspring ; Eggs, Worms, Nymphs, complete Wasps, all are involved in

Their Severity.

L the

the common Desolation ; they cast every thing out of the Hive, and leave the very Cells in Ruins.

Chev. What can occasion this Change, and inspire them with so much Fury ?

Prior. 'Tis because they are sensible they have no more time allotted them to bring their Embrios to Perfection, and therefore resolve to charge themselves no longer with an unavailing Care. When the Sun shines they sometimes take the Air, but Joy and Alacrity ceases among them ; they all languish and disperse ; they shrink from the Cold, and endeavour to shroud themselves as commodiously as they can. Those that continue in the Hive pass the Winter there without either having, or seeking any Sustenance. They are either benumbed or kill'd by the Frost, and sometimes, out of eight or nine thousand Wasps, or a much greater Number that inhabited the Hive, only two or three Dams survive.

Chev. How can the Species then be preserved ?

The Fecundity of Female Wasps.

Prior. The Mothers are the most vigorous, and their Bodies the best adapted to resist the Cold. Could you believe that one Female Wasp should be sufficient to produce a whole Swarm the ensuing Year ? She builds two or three Cells

Cells that form a kind of little Cluster, glew'd by the Stalk to the Sides of the Cavity she has either dug or found. There she lays and hatches a couple of Mule Eggs, and seeks for Food to support the Young. The whole Care lies upon her, as you observe. The two Worms satiate themselves with eating; after which they spin, for some Days, and then close up the Entrance into their Cells. You see there are two young Wasps already in Being. The parent is discharged from the Care of their Maintenance. She forms two other Cells, and whilst each of the new Eggs she has laid are hatching, and the young coming afterwards to Maturity, the first Mule-Wasps break out of their Confinement, and begin to work with the Mother Insect; and now there are three in Company. Fifteen Days after which the second Brood adds to the Number; they increase, and begin to enjoy all the Advantages of Society. They accommodate themselves with a large and commodious Apartment. The little Cluster of Cells is daily augmenting; and when the Mother lays first a Male, and then a Female Egg. You would imagine she did all this by Injunction, since she adjusts the Dimensions of the Lodge to the Size of the Male or Female

that is to be born. The Male becomes a Husband, and the Female a Mother. If there are two Mothers in the Month of *May*, there will be fifty within three Weeks afterwards, and these fifty will produce above ten thousand Wasps before the Month of *October*.

This, Sir, is what I had to observe upon the Article of Wasps. It is not material for me to entertain you with any other Species of these Insects, some of which hang their Nests on the Branches of Trees; and others, who are as large again, and sometimes twice as large as the common sort, build their Nest under a Roof, or in a Pile of Timber. The Industry and Prudence of each Species is much the same, and you may form a Judgment of the Works of these last, by what I have related of common Wasps, whose Conduct I have had better Opportunities of observing. But that which, above all, I am never weary of admiring, in all these Species, is the Variety, and at the same time, the Justness of the Means, by which Providence arrays, feeds and defends every Class.

Cher. But you have told me nothing Sir, of the Sting of a Wasp: are they not provided with one?

Prior. Not provided with one? —

Yes, I am but too sensible of it to my cost, and have felt it more than once ; I assure you I have smarted pretty handsomely, before I could make the discoveries I have imparted to you ; but I would willingly be exposed to greater Hazards, provided they would enable me to teach you any useful Knowledge in an agreeable manner.

Chev. It is not reasonable that I should have all the Pleasure, and you the Pain.

Prior. Pardon me, Sir ; nothing is more consistent. Good Sense requires that Thorns and Stings should fall to the Lot of him who undertakes to teach others, and that Pleasure alone should be the Share of him who is willing to learn.

Chev. I think myself happy to have been into such Hands. And now, shall we make a Transition from Wasps to Bees ?

Prior. I shall do it with Pleasure, in explaining to you the Structure of a Bee's Sting, I shall sufficiently describe that of a Wasp, which is the very same. But we must defer this Subject till To-morrow. At present 'tis impossible for me to enter

upon it; for I see some People waiting for me. I am really a Servant to my Parishioners, and tho I have a great deal of Pleasure in your Company, yet I am obliged at present to take my Leave.

The End of the Fifth DIALOGUE.



B E E



B E E S.



DIALOGUE VI.

The Count de JONVAL.

The Countess de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Countess.



WE have at last disengaged ourselves, Sir, from the Company that interrupted our Conversations ; and

the *Prior* has sent to acquaint us, that he will be here immediately. In the mean time, may we know what your conversation turned upon Yesterday?

Chev. Instead of entertaining me with long Discourse on the various Condi-

tions and Employments of Wasps, the *Prior* brought me an intire Nest of those Creatures ; he shewed me an Inclosure filled with several Ranks of Stories, and a number of Apartments, some quite open, in which there was only one Egg, or a living Worm, others were closed up, and lodged the *Nymphs* that were ready to become perfect Wasps. Others had their Doors begun to be broken down, out of which I saw a beautiful Wasp issue, as I was carrying the Nest the *Prior* presented me with, to my Chamber. I intend to have a Box made on purpose to preserve it.

Count. Take care, however, to expose it for some Days in the warmest Sun-shine, or even at the Fire, to destroy the Insects that may still be living there. I need not give you a Reason for this Precaution. As to the rest, I am very glad you have an Idea of the Labours of a Wasp, it will make you more easily comprehend our Account of Bees.

Chev. I see the *Prior* coming up to our Arbour. What does he carry under his Arm? I fancy you'll find it to be another Present for me.

Countess. He certainly brings you some new Essay, capable of ocular Demonstration.

stration. 'Tis no less than an Honey-Comb.

Chev. That is what I have never seen. It is a happy thing to have to do with the *Prior*; for one immediately finds every Wish gratified.

Prior. I had no occasion, Sir, to go very far for what I have brought, it was all at my own House.

Count. Let us be seated then; our Conversation must now turn on a very important Subject: we are going to engage in Politicks, and the Government of States.

Prior. Our Conversation must be a little diversify'd, and set off with an Air of Dignity. I Yesterday entertained the *Chevalier* with nothing but Robberies and Murders, but we will talk To-day of publick Welfare, Colonies, OEconomy, Policy, and Application to Labour, for these make up the distinguishing Character of the Nation of Bees. Whatever can be said on that Subject may be reduced to two Classes, one comprehends the Particulars which are obvious to all the World, and familiar to the Peasants themselves. I shall not put the *Count* to the Trouble of giving us a Detail of these, there are other Points of greater Curiosity, which cannot be known without the Aid of a
Glas

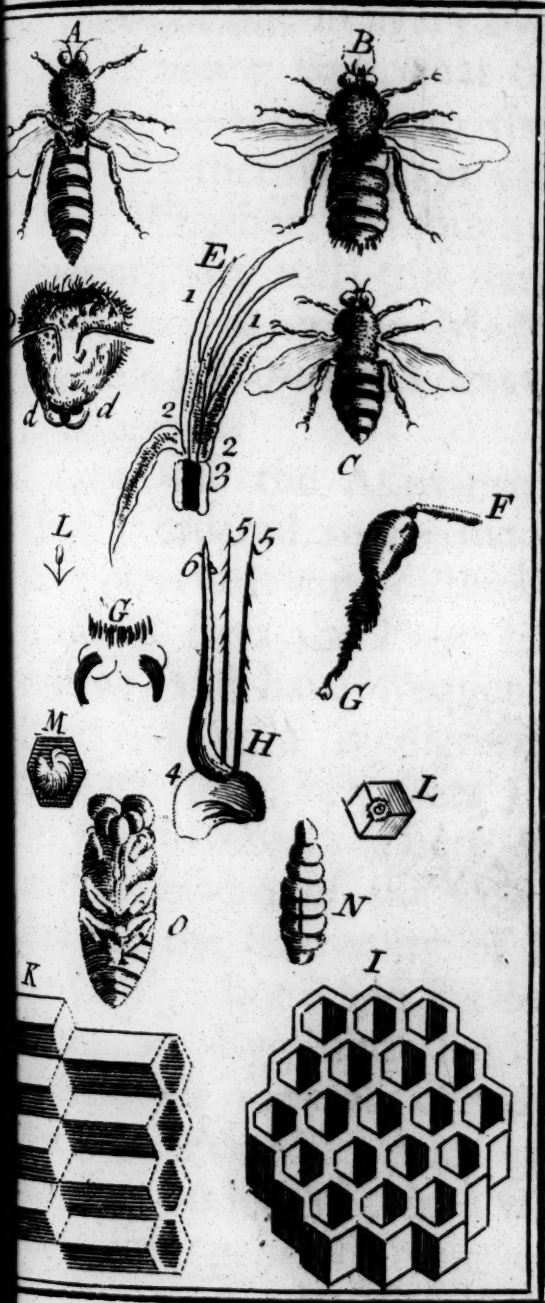
Glass Hive and philosophic Eyes. His Lordship, who is very well provided with both, will take upon him the Province of instructing us.

Chev. It is true, Sir, that the Bees have a King?

Prior. Is it certain that you may distinguish three sorts of Bees in a Hive*. The first are the common Species, who make up the Populace; are charged with all the Work, and seem to be neither Male nor Female. They are all furnished with a Trunk for their Labours, and a Sting for their Defense. The second sort are the Drones, who are of a more dusky Complexion, and bigger than the Bees by one third, tho some indeed have been found of the same Size with those. The Drones have been thought to be the Males, and besides this they have no Sting. There † have been found above an hundred of this Species in a little Hive of seven or eight thousand Bees, but the Number is three or four times as great in a large Hive of seventeen or eighteen thousand. There is likewise a third sort, much more vigorous and long than the Drones themselves, and

* Memoirs de l'Acad. des Scienc. 1712. M. Maraldi. Leeuwenhoek's Arcan. Nat. Tom. iii. Ep. 135

† Maraldi.





who are armed with a Sting like the generality of Bees †. It is thought there is but one of these in each Hive, or at least but one in every Swarm or Colony of young Bees, that from time to time are detached from the Hive, and go to fix themselves in another Situation. Whether we ought, with the Ancients, to call this large Bee, the King; or, with the Moderns, give it the Title of Queen, I leave the *Count* to determine.

Count. By the Assistance of a Glass Hive I ordered to be made for me, I have observed very distinctly the three Classes of Bees the *Prior* has been describing, and have frequently seen the large Bee, who is dignified with the Title of King, marching from Chamber to Chamber. There was nothing The Queen. at the Bottom of the Cell before she sheathed the Extremity of her Body in the Cavity; but when she retired, I observed an Egg left behind: From whence 'tis natural to conclude this Bee to be Female. And, as I have often taken notice, that in a whole Swarm there was generally but one of this Species, who indeed is very remarkable, tho there are sometimes two, but never

† Leeuwenhoek Arcan. Nat. Tom. iii. Ep. 135.

more than three, I thought it more proper to call her the Queen. However, I would not disagree with any one that thinks fit to entertain a different Opinion. But what are the *Prior's* Sentiments about those large Bees they call Drones? They are not Foreigners, because I have seen them born in Cells prepared for their Reception, and which are larger than the others. What then is their Province? Shall we assign them to the Queen, as her Comforts? My Hive has not as yet, furnished me with Discoveries on that Point that are altogether satisfactory.

Prior. All that I know, Sir, of Drones, is this; they have a Bag of Honey in their Bellies, like other Bees; with this Difference, that the Bees have their Bag continued by a little Canal to their Neck, by means of which they discharge the Honey into the general Magazines. And when you press a Bee never so lightly, the Honey immediately evacuates thro' this Passage, which is not the Case with the Drone. That Creature eats and retains all for its own Benefit, and contributes nothing to the common Stock. It lives in Plenty, and never works, or wanders in the Fields; but, at the most, only takes the Air and walks in full Liberty
round

round the Hive, it has no Sting, and the Reason why Nature did not arm it with one is evident : It has no Enemy to fear. As to the rest, I can't persuade myself that a Nation so remarkable for OEconomy, would permit such indolent Companions to dwell among them, unless they were necessary in some Particular. Some have suspected that their Province is to supply the Queen with Issue, or, in other Terms, to people the State with Subjects.

Count. There is something more to be observed: By the Anatomy that has been made of them, some have thought they have discovered in their Structure, that they were the Authors of Generation. I have endeavoured all I could, to observe in my transparent Hive, what Character the Drones maintained with respect to the Queen ; and this is all the Discovery I was capable of making. The Queen keeps herself retired in the upper Apartments of the Comb, and which, if you please, we will call her Palace. She very seldom appears publick, and whenever she shews herself you will always see her march with a sedate and majestick Air. You may call her, *Chevalier*, but the Matter is quite otherwise. She never walks alone, and she is not attended by the whole Swarm,

The
Males.

Swarm, she is, at least, followed by several large Bees, who are probably the Drones that form her Court. As the Queen takes her Walks but very rarely, and as they apparently tend to the general Welfare, whenever they happen there is a great Festival thro' all the Dominions; the whole Nation comes abroad, and every Subject is all Transport; and, in order to give her a solemn Reception, the Bees hang upon one another with their Paws, and in less than a Moment form a large Veil, behind which 'tis impossible to discover any thing that passes. This Veil, if you please, shall be a Suit of Tapestry hung in honour to the Queen's Progress, or else a Curtain drawn by the Domesticks before her —.

Prior. Your Lordship ascribes to them very noble, or, at least, very modest Intentions.

Chev. Is not this Ceremony, a Dance occasioned by the Festival?

Countess. A Dance? for my part I don't know, but am sure it is the last thing the *Prior* would admit; for he is not very favourable to Dances.

Count. As to the rest, whatever may be the Intention of these Creatures in hanging thus together by their Paws, and forming themselves into a Chorus at the

Approach of their Sovereign, the Fact is incontestable ; and I have afterwards observed, that the Queen proceeded from Chamber to Chamber, and in each of them deposited an Egg, after she had privately examined whether each Apartment was empty ; and whilst she sunk the Extremity of her Body into any Cell, the Drones of her Court ranged themselves in a Circle a-round her, and turning their Faces to the Queen, fluttered their Wings, and seemed to celebrate the Nativity of this new Progeny. The peopled ten, twelve, and sometimes more Cells at each Fecundation ; and herself, prolifick enough to give a birth to six or seven thousand Young : in the Space of twelve Months she can see her Children's Children, by the Instrumentality of two or three other Bees like herself, and is, in one Summer, the Mother and Grandmother of eighteen thousand Descendants.

Prior. What seems to complete the proof that these Drones are so many millions, destined only to multiply their species is this ; they are liberally provided for the whole Summer, but when the Queens have discharged their swarms, and at the Approach of Autumn it begins to be foreseen that there will neither be Time nor Warmth sufficient

ficient to rear a new Family, then the Drones are persecuted and expelled; they are found to be chargeable to the Community, where they only consume the Provisions. The Bees no longer allow them to continue in the Hive. Their Aversion extends even to the young Drones; they eject them from their Cells, and first kill, and then cast them out of the Hive, and after this pursue their Fathers. 'Tis to no Purpose for them to be desirous of staying there; the Bees seize them by the Wings and Shoulders, they jostle and fatigue them, and without the least Remorse banish every Individual, except perhaps a very few, and even those of a less rapacious Species, whose Expences are little more supportable. These are reserved for the Necessities of the ensuing Year, which I the rather remark, because the Queen renews her Pregnancy in the Spring; tho' one sometimes sees among them only those Drones who, their Shape and Dimensions, differ very little from common Bees.

Cher. And what becomes of the poor Drones? they give me a great deal of Concern.

Prior. Rains, Birds, and Famine, their Destruction, and the Ground near the Hive is covered with their Carcasses.

Count.

Countess. I find the Husbands make no very agreeable Figure in this Country.

Count. The Maxim is, that the general Welfare should be the first Law of the State.

Prior. The Bees don't think themselves under any Obligation to support the Idle, who in one Season of the Year would consume all the Labours of the other, and especially at a time when the Bees themselves can find nothing more to subsist on. And so, *Chevalier*, the Drones are constrained to be their own Providers, it is owing not only to Economy but Necessity itself.

Cher. You are very unwilling, Sir, that one should entertain an ill Opinion of your favourite Bees, and it is evident you are very fond of this Insect.

Prior. I confess they furnish me with profitable Revenue; and I have known some Years wherein my Bees brought me in more than my Benefice.

Countess. That is not the Reason why they are favoured with your Complaisance; you are warm in espousing their Cause, because they faithfully observe the Moral you inculcate, That those who will not work should not eat.

Prior. That may very well be, but Complaisance and Interest a-part, impossible to give even a small At-

M

tention

tention to the Manners and Maxims of this little People, without finding them perfectly amiable in their Conduct as well as their Industry.

Chev. Their Manners, I confess charm me, but their Labours deserve a little Consideration, and that is the Point I would willingly come to.

The Implements
of Bees.

Prior. Before I entertain you upon this Head, it will be necessary to let you see their Implements. The *Count*, who has survey'd them with his Microscope more accurately than myself, will not be satisfied with any thing I can advance.

Count. I willingly accept of the Commission, but don't undertake to give you a complete Analysis of a Bee's Body; it will be sufficient, my dear *Chevalier*, to take notice of the principal Parts with which Nature has supplied them, and the Use to which they are devoted.

The Form
of a Bee.

The Body of a Bee is divided by two Ligaments into three Parts or Portions, the Head, the Breast, and the Belly.

The Jaws.

The Head is armed with two Jaws, and a Trunk: The former of these plates like Saws opening and shutting to the Right and Left: These Saws serve the instead of Hands, to hold and knead their Wax, and to throw away whatever

inconmodes them. The Trunk is a ^{The} Trunk.
 — but I shall do better to imitate

the *Prior*, and address myself to your Eyes, since I have an Opportunity of doing. I have here, a Couple of these Trunks glew'd upon two Slips of Paper. Look upon them one after another in the Microscope.

Prior. They could not be more advantageously placed to make one distinguished by the other. Perhaps the *Chevalier* may think these two Figures are the same, or two Trunks that have perfect Similitude to each other.

Chev. I see one is twice as long as the other, that which is the longest is thick at one End, and goes tapering to the other ; it has likewise a small Bend-
 ing towards the Middle, and at the Bottom is wound about by four Branches that are hollow within like a Reed cut into four parts. I don't comprehend all this.

Count. What you say is, however, very just. Have a little Patience and observe the other.

Chev. The other is still thicker, very short, and without the four Branches.

Count. Are you sure of that ?

Chev. Stay, my Lord, if you please ; think I begin to discover them. They are placed near one another : This se-

cond Trunk must needs be sheathed, and the Branches perform the Office of a Scabbard. The first Trunk is unfolded for Work, and the second wrapped up in the peaceful Enjoyment of its Acquisitions. This evidently justifies what the *Prior* told me last, That the minutest things in Nature were appointed to some peculiar End and Purpose; and that the Deity is as conspicuous in the Structure of a Fly's Paw, as he is in the bright Globe of the Sun himself.

Prior. You must habituate yourself to comprehend that this Appointment is certain, even in those things where it is not understood; because at every Step you will find it, tho the Reason does not immediately appear: 'tis your Part to inquire after it, and to admire and glorify God in the Discovery. Should I shew the Trunk of a Bee to whom you please, it may be said, it is but a Fly's Paw; to what Use can it be appropriated? And yet this Instrument is such that a Bee, with its Assistance, can collect more Honey in one Day than a hundred Chymists could extract in a hundred Years, and the Wisdom of the Creator, that appears so evidently in the Present he has made of this precious Instrument to the Bee, is not less apparent.

parent in the Means with which he has furnished her for its Preservation. For this Trunk is long and taper, as well pliant and flexible in the utmost degree, that the Insect may be enabled to probe to the Bottom of Flowers thro' Impediments of their Foliage and thieves, and drain them of their treasured Sweets. But were this Trunk always extended it would prove incommodious, and be liable to be shattered by a thousand Accidents; it is therefore composed of two Pieces connected by a kind of Spring, or Joint, in such a manner that, after the Performance of its necessary Functions, it may be contracted, or rather, folded up; besides this, it is fortified against Injuries by four strong Scales, two of which closely sheath it; and the two others, whose Cavities and Dimensions are larger, encompass the Whole.

Count. Let us now proceed to the rest ^{The} of the Body. The middle Part, or ^{Breast.} of a Bee, sustains the Legs, which are six in Number, together with the Wings, two greater and as many less, which serve not only to transport her where she pleases, but by the Noise they make, to advertise the Bees of their departure and Arrival, and likewise to unite them mutually when they are

at work. Here is a dead Bee, let us take notice of the Hair which covers her whole Body, and assists her to retain the little Grains of Wax that fall from the Top of the Chieives to the Bottom of the Flowers. In the next place observe, at the Extremity of her Paws, two little Hooks, that the Microscope will render visible, and exhibit to you in the Form of two Sickles rising out of the same Handle, with their Points opposite to each other. These hooked Claws that are so serviceable to the Bee in a thousand Instances, are clapped over two Balls of Sponge, to render her ordinary Manoeuvres more easy and agreeable.

The Belly. The Belly of this Insect is distinguished into six Rings, which lengthen and contract themselves by sliding on one another. The inside of this Region of the Body consists of four Parts, the Intestines, the Bag of Honey, the Bag of Poison, and the Sting.

The Office of the Intestines is to digest the Food, in the same manner as the Function is performed in all other Animals. The Bag of Honey is as transparent as Crystal, and contains fluid Sweets extracted from Flowers. The Bee, a small Portion of which remains in the Bag to nourish the

mal, but the largest Quantity is discharged into the little Cells of the Magazine, to support the whole Community in Winter. The Bag of Poison or Gall, hangs at the Root of the Sting, thro' the Cavity of which, as thro' a Pipe, the Bee ejects some Drops of this venomous Liquor into the Wound, and renders the Pain more excessive.

The Sting is composed of three parts, The Sting.
the Sheath, and two Darts*. The sheath tapers into a very fine Point, near which is an Opening calculated to give a free Passage to the Gall. The two Darts are ejected a little lower, and are planted with small sharp Points like the Beards of a Hook, and which being a little obliquely render the Injection more afflictive, and create the more a great deal of Trouble to draw them out; and indeed she never disengages them if the wounded Party happens to start, and put her into Confusion: but if one can have Patience to continue calm and unmoved, she brings down these lateral Points, and clinches them round the Shaft of the Dart; by which means she recovers her Weapon, and gives less Pain to the Person wounded.

Theol. Phys. Derham.

The Scabbard is likewise finely pointed and makes the first Penetration, which is succeeded by the Injection of the Darts and poisonous Liquor. This Scabbard has very vigorous Muscles which contribute to its Disengagement from the Wound; but when it has been plunged two deep, these Muscles are torn from the Body of the Bee, and remain with the Sting. The Liquor which she at the same time infuses into the Wound causes a Fermentation, attended with a Swelling which continues several Days, but that may be prevented by immediately drawing out the Sting and enlarging the Puncture, to give Perspiration to the venomous Matter. So much for the Implements of Bees.

Let us now proceed to their Labours, and particularly the Structure of their Combs.

Chew. Permit me, my Lord, to ask the *Prior*, what Method they take to assemble all the Bees in one Hive?

Prior. Do but image to yourself a Tribe of these Animals lodged either in the Hollow of a Tree, the Cavity of a Rock, or in a Hive they have accidentally met with. There they bring up their Young, and when these are come to Maturity, they raise another Progeny

The Hive.

The whole Society dwell peacefully together, as long as their Habitation is sufficiently spacious and convenient; but when the Numbers multiply to such a degree as to make them incapable of rearing a new Generation without incommoding themselves, then the old Bees, in whom the Rights and Sovereignty of that Republick are vested, publish an Edict commanding all of such an Age and under, to seek a new Settlement, and evacuate the Place at a certain time, threatening the Disobedient with the utmost Severity of their Stings. I may perhaps be mistaken in the Style of the Proclamation, since I have never seen it; but in Reality, the Refusal to retire at the time prescribed draws a bloody War on the young Swarm. However, the Command is generally received with Submission; and on some certain Day, or rather at the same Instant, all the young Nation, with their Queen in the Van, abandon the Hive, and expatiate thro' the Country in quest of a new Habitation. This Detachment may be properly called a real Colony. The old Bees always continue in Possession of their ancient Habitation.

Chev. Methinks I am listening to the History of the *Tyrians* and *Sidonians*, who being streighten'd for want of Room,

Room, and growing very numerous, dispatched Colonies to *Carthage* and *Cadiz*, as well as many other Places. But I interrupt the History of the Bees.

Prior. When our young Bees have taken the Wing, they wander with a buzzing Flight thro' the Air, in search of a commodious Retreat, and sometimes fix in a Cluster upon the Trunk of a Tree, and sometimes on a Branch. It may be supposed that some of them are deputed to the Office of Scouts, and when in pursuance of their Commission, they have found either a spacious Cavity in a Wall, or the Hollow of an old Tree, or else a Hive which the Country People, who are always vigilant on those Occasions, take care to present them with, after they have rubbed it over with Balm, Thyme, and other odoriferous Herbs; the Queen, upon the Representation made to her, or in consequence of her own Observations, puts herself in Motion; upon which the whole Cluster disengage themselves and follow their Sovereign, who enters into the Cavity presented to her, takes Possession of the Place, and there settles with all her People. 'Tis frequently the Custom to ring a little Bell, or tinkle a brass Pan, to advertise them

them that a Mansion is prepared for their Reception. This Sound makes an Impression upon them, and for a Moment composes their Disorder: And perhaps they mistake it for a Peal of Thunder likely to be succeeded by a dangerous Storm. However, in the very Instant either of the Fear or Tranquillity that the Sound inspires, they very attentively consider the offer'd Retreat. They are not displeased if you oblige them by some gentle Constraint to enter into the Hive; or perhaps their natural Inclinations may determine them to chuse a Sanctuary there. When this is done, he that presented the Hive to them removes it very tenderly, and they suffer themselves to be carried off, without any Resentment. The Hive is then placed upon a Stand of level Planks closely riveted together, or upon a Plat of Earth crufted over with a Superficies made of the Dust of Bricks or Tiles, in order to exclude all Insects and Exhalations. A little Opening is left at the Bottom of the Hive, after which they range themselves in the manner they are well acquainted with: what is afterwards transacted there falls more within the *Count's* Province than mine.

Count.

The
Comb.

Count. When the Labours of Bees are under our Examination, we may consider the Materials they employ in Building, the Use to which that Building is appropriated, and the manner wherein the Whole is transacted. The Materials † are only Glew and Wax, which they collect from various Flowers; the Building is used as a commodious Habitation for themselves and their Offspring; and as to the manner of erecting it, let me inform you of some Instances of their Sagacity. I am unacquainted with the Language spoken by the Nation of Bees, but that they have a Language which they understand, and agree to use for the mutual Communication of their Thoughts, is a Fact I take to be undeniable. When they begin to build the Hive, they divide themselves into four Bands; one of which is consigned to the Fields, to collect Materials for the Structure: The second, work upon these Materials, and form them into a rough Sketch of the Dimensions and Partitions of the Cells. All this is polished and completed by the third Band, who examine and adjust the Angles, remove the superfluous Wax, and give the Work its necessary Per-

† M. Maraldi.

fection. The fourth Band bring Provisions to the Labourers who cannot leave their Work ; but no Distribution is made to those whose Charge calls them to the Fields, because it is supposed they will hardly forget themselves ; neither is any Allowance made to those who begin the Architecture of the Cells, and indeed their Province is very troublesome, because they are obliged to level and extend, as well as cut and adjust the Wax with their Jaws, but then they soon obtain a Dismission from their Labour, and retire to the Fields to regale themselves with Food, and wear off their Fatigue with a more agreeable Employment. Those who succeed them, draw their Mouth, their Paws, and the Extremity of their Body, several times over all the Work, and never desist till the Whole is polished and completed ; and as they frequently stand in need of Refreshments, and yet are not permitted to retire, there are Waiters always attending who serve them with Provisions when they require them.

Cher. Have you seen this, my Lord ?

Count. Very perfectly. They express their Meaning by Signs. The Labourer who has an Appetite, bends down his trunk before the Caterer, to intimate that

that he has an Inclination to eat; upon which the other opens his Bag of Honey, and pours out a few Drops, which I have distinctly seen rolling thro' the whole Length of his Trunk, that grew sensibly swelled in every Part thro' which the Liquor passed. When this little Repast is over, the Labourer returns to his Work, and his Body and Paws repeat the same Motions as before.

Cher. Is it very long before the Work is completed?

Count. Tho the Elegance and Proportions of it are admirable, yet the Builders are so indefatigable †, that a Honeycomb composed of a double Range of Cells backed against one another, and which is a Foot long and six Inches broad, is finished in one Day, so as to be capable of receiving three thousand Bees.

Besides this, the Symmetry of these Combs is abundantly more complete than that of a Wasp's Nest; for the Cells not only terminate at the Bottom in a Point accommodated to receive the little Egg, and concenter the Warmth to it, which it would not enjoy in the same degree were it deposited on a Flat; but they are likewise composed of little

† M. Maraldi.

triangular Panes that regularly unite in a Point, and exactly correspond Pane against Pane, in the like Extremities of the opposite Cell. Break a few of these little Apartments, and you will find the Fact to be as I have described. Take notice also that they shape and dispose their Combs in a very different manner from the Wasps; for whereas these Insects build but one Range of Cells in each Tire, and place them horizontally over one another, the Bees make their Cells double, or composed of two Ranks of Apartments, the Extremities of which touch each other, and are perpendicularly suspended with an Interval between the two, that affords the Bees a Passage sufficiently spacious, and at the same time contracted enough to promote all the Warmth they can possibly need.

Chev. But, my Lord, I find here, at the Entrance into all the Lodges a kind of Ledge, which makes the Opening at the Door narrower than the Dimensions within; whereas the Passage into Wasp's Cell is as wide as the Apartment itself.

Count. This is another wise Precaution: for as the Bees live seven or eight years and more, and the Wasps seldom survive one, in which Circumstance the

the Conduct of Providence is very remarkable, and calls for our Gratitude, they fortify the Aperture of their Cells with this Ledge, which being joined to that of the neighbouring Cells, makes the whole very difficult to be shattered, so that the Work continues several Years uninjured, notwithstanding the Shocks occasioned by the frequent Ingress and Egress, as well as the repeated Efforts of the Mothers who come there to lay their Eggs, and notwithstanding the Motions of the Labourers who deposite their Wax and Honey there, and the Struggles of the Nymphs, who, when they become Bees, make vigorous Endeavours to disengage themselves from their Confinement.

Prior. These Habitations, *Chevalier*, differ very much from ours which always decay with Time, whereas those grow stronger by Duration, at least to a certain Period.

Chev. How can that be?

Prior. The Foundations of our Houses sink with the Earth they are built on, the Walls begin to stoop by degrees, they nod with Age, and bend from their Perpendicular; Lodgers damage every thing, and Time is continually introducing some new Decay. On the contrary, the Mansions of Bees grow stronger

stronger the oftner they change their Inhabitants. Every Worm, before its Conversion into a Nymph, fastens its Skin to the Partitions of its Cell, but in such a manner as to make it correspond with the Figure of the Angles, and without the least Prejudice to the Regularity. In one Summer the same Lodging may serve three or four Worms successively, and when that Season returns, it can again accommodate the same Number. Each Worm never fails to fortify the Pannels of his Chamber, by arraying them with his Spoils; and the next Apartment likewise receives the same Augmentation. I have sometimes found seven or eight of these Skins spread over one another, so that all the Cells being incrusted with six or seven of these Coverings, and all well dried and cemented with a strong Glew, the whole Fabrick daily acquires a new degree of Solidity.

Chev. But I find an Inconvenience in this, Sir; for there may be so many Skins glewed over one another as to render the Apartment too contracted in its Dimensions.

Prior. The Difficulty you start is very reasonable, and I must refer you to the Count for a satisfactory Answer.

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Count.

Count. Can you guess how the Bees proceed in this Case? They alter the Property of these Cells, and lodge their Young where they stored their Honey, and at the same time deposite their Honey where they lodged their Young: at least this is the Opinion of some Observers, tho I shall not undertake to warrant it. As to the rest, you find the Bees are skilful enough in their Works to induce you to believe they know when it is proper to clear away Superfluities; and it must be confessed, that at the End of six or seven Years the Cells become too contracted, and all the Work grows ruinous. You have seen, my dear *Chevalier*, their Expertness in Architecture. We must now give you some Insight into their OEconomy, and direct our Observations to what passes in the Magazines of Wax and Honey. Their Structure and Use will be equally entertaining to you. They have first of all, the Precaution to —

Chev. Ah! Sir, all is at an End: I see five or six Foxhunters, who are now alighting in the Court, and the Servants are going to take their Horses into the Stable.

Countess. We need not break up in a Hurry, those Gentlemen must have their Boots taken off, and Notice will be given

us when to wait on them. The *Prior* has shewn us the Comb, and its Contents; but has not given us a Sight of what is wrapt up in that Paper.

Prior. You know, *Chevalier*, the Cells where the Young are lodged; you likewise have seen those which contain the Wax; and I have here, in a Sheet of white Paper, a Piece of the Honey-Comb.

Chev. Must not something be done to the Honey before it can be fit to eat?

Prior. No, Sir, it is here in all its Purity, and infinitely better than when it has been degenerated by the Hands of Men; pray venture to taste a little, only throw the Wax away.

Chev. I never tasted any thing more delicate, and am no longer surprized that the Authors I have read, always speak of Honey when they would acquaint us with something agreeable.

Prior. Honey was the Sugar of the Ancients; but we make very little use of it now, since we have had Sugar from the *East* and *West-Indies*.

Countess. In my Opinion, *Chevalier*, you have pretty much of the Ancient palate.

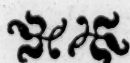
Chev. Madam, I never knew till this Day what Honey was.

Countess. Be wise then in time. You see the *Prior* is always the same, he gives a Relish to every thing he does, and when he takes his Leave of us, he will go and chatechise in some little Hut, where, instead of Honey, he will not fail to distribute his Alms.

Prior. I am very glad my Behaviour pleases your Ladyship ; I shall always continue to give Instruction, and ever part with as much Honey as will be acceptable. Charity is your Ladyship's Province, and I am only your Almoner.

Count. These little Animals that we behold so sociable in their Community are industrious to assist each other, and prevent their mutual Necessities with a surprizing Generosity ; and shall we leave our fellow Creatures in Distress. On the contrary, I am convinced that the finest of all Pleasures consists in preserving Persons from Calamity, and it is a Pleasure capable of increasing proportionably to our Ability to give. But let us wait on the Company.

The End of the Sixth DIALOGUE.



B E E



B E E S.



DIALOGUE VII.

The Count de JONVAL.

The Countess de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.



Entlemen, I desire you to remember that we are this Day to visit the two great Manufactures of Wax and

ney. The *Prior* has taken a particular View of all this ; and I should be d to know, first of all, what this wax is.

Prior. The Bees have two sorts, one is and indifferent, the other much finer

finer *. The first is blackish, and pretty much resembles Grew, or a very thick Pitch; the second is a Species of Rosin, or Turpentine extremely pure, and of an agreeable Seent. They find this about the Seeds, or those innumerable little Grains visible on the Chievs that rise from the Bottom of Flowers. Their Grew is a Composition of bitter Juices which they extract from certain Plants Straw, rotten Wood, and impared acid Liquors.

Chew. Wherein is this Grew useful?

Prior. I'll inform you. When they have found a Hive, or other commodious Habitation, their first Employment is, to close up very exactly, with the Grew, all the Fissures and Crannies and strengthen the weak places, so that the Winds can have no Admission; and the Insects, who would otherwise make Depredations on this Grew, are prevented by their insupportable Aversion to the bitter Flavour.

Count. Upon this Occasion I will relate a Story I was an Eye Witness to. A few Days since a Snail took it into his Head to steal into the Glass Hive at my Window. There was no Entrance to pass thro' but the proper one,

* Maraldi. *ibid.*

at length in he went. The Porters received him very rudely at the Gate; and the first Attacks they made upon him with their Stings obliged him to march with more Expedition: but the stupid Animal, instead of retreating, thought to save himself by going forwards, and he advanced into the very middle of the Hive; upon which a whole Troop of Bees fastened upon him at once, and he immediately expired under their Strokes. The Conquerors were then in no little Perplexity how to get rid of the Carcass, and a Council was instantly held upon that Occasion.

Chev. And your Lordship, without doubt, understood all their Debates.

Count. From first to last. The most experienced Sages among them reasoned in this manner: To drag the Carcass out by main strength, is an Impossibility; the Mass is too unweildy, and besides, the Body is fixed to the Floor of the Hive by its own Glew; and to leave it where it lies would be very inconvenient, because it would prove an alluring Regale to the common Flies, and at the same time be liable to Corruption and Worms: and these Worms, when they have devoured the Snail, will infalli-

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bly ascend to the Comb, and attack the young Bees. The Damage was evident, and required an immediate Remedy; but you will hardly guess the Dexterity with which they accomplished it. *Chevalier*, I should be glad to know your Sentiments on the Affair. How were they to conduct themselves on this Occasion?

Chev. So quick upon me, my Lord? You are really very severe, to put the Question to me; for it will appear that the Bees had more presence of Mind than myself. But pray, how did they proceed?

Count. They incrusted the whole Snail with Glew, and cemented it so close that all the external Air was excluded; and as no Insect could have Access to deposite her Eggs in the Carcass, so when this should be reduced to Corruption no malignant Steams would transpire thro' the Inclosure.

Chev. Will your Lordship let me see the poor Snail's Tomb?

Count. You shall have a Sight of it To-day. It wants nothing but an Epitaph.

Chev. When the Inside of the Hive is well pitched, and the Bees under Shelter, how are the Cells disposed?

Prior.

Prior. The Foundation of the Building is fastened to the Top of the Hive, there they lay a Bed of Glew, to which they fix the first Cells of the Comb, which they continue downwards, and enlarge them till they have no more room left. The Comb is divided into three Cantons, one where they rear their Young, another where they store their Wax for their future Occasions, and the third where they preserve their Honey for the Winter.

I have nothing particular to acquaint you with about their Young, the Circumstances are pretty near the same as they are with the Wasps. When the Worm has left the Egg, the Mother constantly supplies it with Honey ; and at the Expiration of ten or twelve Days, when it has had its fill, an old Bee comes and closes up the Cell with Wax. The Worm in its Retirement changes into a Nymph, and the Nymph becomes a Bee ; and after fifteen Days Repose, the young Bee pierces thro' the waxen door, and when she has dried her Wings, flies among the Flowers, steals their Sweets, and is perfectly acquainted with every necessary Circumstance of her future Conduct.

As to the Structure of the Wax the Count's Observations have been more accurate than mine.

Count.

The Wax.

Count. I confess it is a Particular that has very much amused me. The Wax is a Provision altogether as necessary for them, in one Sense, as the Honey itself; they build their Apartments with it, and it closes the Cells of the Nymphs as well as those where the Honey is treasured. When any Accidents happen, any Fractures open, or whenever the Species grows too numerous, they recur to the Wax, and therefore are always careful to provide a sufficient Quantity in good time. They search for it upon all sorts of Trees and Plants, but especially the Rocket, the simple Poppy, and generally all kinds of Flowers. They anoint it with their Hair, with which their whole Body is invested. 'Tis something pleasant to see them roll in the yellow Dust that falls from the Chieives to the Bottom of the Flowers, and then return covered with the same Grains; but their best Method of gathering the Wax, especially when it is not very plentiful, is to carry away all the little Particles of it with their Jaws and fore Feet, to press and work them up into little Packets, and then to slide them one at a time, with their middle Feet into a Socket or Cavity that opens at their hinder Feet. This Cavity is made

to receive the Wax like a Spoon, and the Hair which covers their Feet serves to keep the Burden fixed and steady till their return home. They are sometimes exposed to Inconveniences in this Work by the Motion of the Air, and the delicate Texture of the Flowers that bend under their Feet, and hinder them from packing up their Booty; on which Occasions they fix themselves on some steady Place, where they press the Wax into a Mass, and wind it round their Feet, making frequent Returns to the Flowers; and when they have stocked themselves with a sufficient Quantity, they immediately repair to their Habitation. Two Men, in the compass of a whole Day, could not amass so much as two little Pellets of Wax, and yet they are no more than the common Burden of a single Bee, and the Produce of one Journey. Those who are employ'd in collecting the Wax from Flowers, are assisted by their Companions who attend them at the Door of the Hive, ease them of their Load at their Arrival, brush their Feet, and shake out the two Balls of Wax; upon which the others return to the Fields to gather new Treasures, whilst those who disburden'd them convey their Charge to the Magazine. However, I have seen some
Bees

Bees who, when they have brought their Load home, have carried it themselves to a Lodge, and there delivered it, laying hold of one end with their hinder Feet, and with their middle Feet sliding it out of the Cavity that contained it; but this was evidently a Work of Supererogation, which they were not obliged to perform. The Packets of Wax continue a few Moments in the Lodge, till a Set of Officers come, who are charged with a third Commission; which is to knead this Wax with their Feet, and spread it out into different Sheets laid one upon another. This is the unwrought Wax, which is easily distinguished to be the Produce of different Flowers, by the Variety of Colours that appear in each Sheet. When they afterwards come to work it, they knead it over again, they purify and whiten it, and then reduce it to an uniform Colour. They use this Wax with a wonderful Frugality, for it is easy to observe that the whole Family is animated by Prudence, and all their Actions regulated by good Government. Every thing is granted to Necessity, but nothing to Superfluity; not the least grain of Wax is neglected, and if they waste it, they are frequently obliged to provide more, at those very times when they want to get their

their Provision of Honey. When they open the Cells of Honey, they take off the Wax that closed them, and carry it to the Magazine. You may likewise judge of their OEconomy by another Instance: When a young Bee frees itself from its Prison, by breaking down the Partition of Wax that shut it up, two old Bees immediately present themselves, and carry away all the Remains of this waxen Partition; after which they immediately repair the Ledge of the Cell, and bear all the Wax that is left to the Repository. Thus you see nothing is lost.

Countess. But is not this OEconomy, my Lord, much of a piece with your Account of the Deliberations about the Snail? I am afraid all the Ingenuity I admire in these Proceedings flows only from you.

Count. I have sometimes, in a Vein of Pleasantry, supplied them with such kind of Reasonings; but, in Reality, the same Wisdom that created these Animals, has enabled them, for their Preservation, to act as consistently as if they were influenced by Reason itself: And as to the Frugality I have been describing, 'tis what you yourself may be Spectator of whenever you please.

Chev.

Chev. Then as to the Honey, my Lord ; will you be so good as to tell me what it is, and how they collect it ?

Count. The Ancients believed Honey to be an Emanation of Air, a Dew that descended upon the Flowers, as if it had a limited Commission to fall only there. But it has been since discovered that Dews and Rain are very opposite to Honey, in their Qualities ; they wash it away, and prevent the Bees from finding it. Honey is rather an Efflux or Transpiration of the finest Particles of the Sap in Plants, which evacuate thro' the Pores, and afterwards condense on the Flowers ; and as these Pores are more expanded in the warm Sunshine, than at any other time, so you never see the Flowers more replenished with a viscous and vermilion Juice, nor the Bees more transported with Ardour and Joy, than when the Sun dispenses his brightest Rays. I likewise take it for granted, that the Season has proved favourable, because excessive Rains either wash away the best Salts from the Soil, or dilute its purest Juices ; as on the other hand, the immoderate Length of a dry Season prevents those Juices from flowing into the Plant.

Chev. Since we know what Honey is, I should think we might

go ourselves and extract it from the Flowers.

Count. Yes; without doubt the thing is practicable. You only want an Instrument for that Purpose. Go to work, my dear *Chevalier*, and make a Trunk: I shewed you a couple Yesterday.

Chev. I deserve to be rallied for my wise Observation: I should rather have asked your Lordship, whether the Bees content themselves with sucking the Honey from the Flowers, and conveying it home; or is it your Opinion, that the Juices of the Flowers are converted into Honey by the Labours of the Bees?

Prior. For my part, I am apt to think the Bee makes no Alteration in the Honey, but collects this delicious Syrup just as Nature produces it; and first fills her Bag and then discharges it into the Magazine.

Count. I am of your Opinion in that particular, and could never observe they were able to condense the Honey when it was too liquid, as *Virgil* affirms. Perhaps it may be true, that when they receive it into their Body they purify, and give it some Consistence. But all I have remarked on the Article of Honey amounts to no more than this: They suck it up with their Trunk, and empty it into the Cells appropriated to receive it;

it; and when they are all full, the Bees close up some with Wax, till they have Occasion for the Honey; the rest they leave open, and all the Members of the Society resort there, and take their Repast with a very edifying Moderation.

Chev. The Bees certainly act with more Regularity than ourselves.

Prior. The Hive is a School to which Numbers of People ought to be sent; Prudence, Industry, Benevolence, Publick-spiritedness, Diligence, OEconomy, Neatness, Temperance; all these Virtues are to be found among the Bees: Or rather, let us say, they read us Lectures upon them.

Count. What most affects me, in these little Animals, is to see them actuated by that social Spirit which forms them into a Body Politick, intimately united and perfectly happy. Look on a Swarm of Bees, and observe the Disposition that influences every Individual. They all labour for the general Advantage; they are all submissive to the Laws and Regulations of the Community; no particular Interest, no Distinctions but those that Nature, or the Necessities of their Young have introduced among them. We never see them dissatisfied with their Condition, or inclinable to abandon the Hive in Disgust to find them

themselves Slaves, or necessitous. On the contrary, they think they are in perfect Freedom, and perfect Affluence, and such indeed they are in effect: They are free, because they only depend on the Laws; they are happy, because the Concourse of their several Labours inevitably produces an Abundance that constitutes the Riches of each Individual. Let us compare human Societies with this, and they will appear altogether monstrous. Necessity, Reason and Philosophy, have established them under the commendable Pretence of mutual Aids and Benefits; but a Spirit of Selfishness destroys all; and one half of Mankind, to load themselves with Superfluities, leave the other destitute of common Necessaries.

Prior. As long as Men are not conducted by the Spirit of God, they are certainly the most unjust and corrupt of all Animals.

Count. I cannot express my Indignation, when I see to what Prostitutions our Species degrade themselves, especially when they are possessed with the fury of Ambition, and determined to live at ease, without giving themselves the least Pain, to see their fellow Creatures barely possessed of Food and Rayment. But let us close this disagreeable

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able Scene, and tho we find our Manners condemned by the Practice of these little Animals, who associate with so much Tranquillity ; yet let us go on to make them the Subject of our Examinations ; 'tis an Article that infinitely delights me. I have seen, at the *Prior's* House, a Glass Hive, wherein, as he has told me more than once, he has had a Swarm of wild Bees. Pray, Sir, favour us with some Account of them.

Wild
Bees.

Prior. As I knew you had made many Observations on the common sort of Bees, I thought it would be better for me to bestow some Notice on those that were Wild, in order to observe the Difference. These Creatures, that several People call Drones, and Hornets are nothing near so industrious and frugal as the domestick Bees. They are more negligent in their Settlements, and their Work is, in every particular, inferior to that of the others ; but for all this, it has its Beauty. The Nest composed of dried Leaves mixed with Wax. This Nest, which they usually build in some Cavity dug in the Earth by a Field Mouse, is well vaulted, to preserve it from Rains and the falling in of the Earth. They worked in the same manner, when they were in the Hive.

Hive, as they would have done in the Field. The Principles of their Architecture are invariable. The Nest is all perforated with different Holes, like a Sponge, so that one may easily see all that passes within. Each Hornet builds with the Wax a little Cell, about the Size of a large Pea, cut thro' the middle, and round and hollow like half an Egg-shell. From these different Cells joined together, results a sort of Cluster very agreeable to the Eye. The Females, whose Number among the Bees and Wasps, appears to be very inconsiderable, lay their Eggs in the open Cells; when this is done, some other Bees close them up with Wax; after which they stand upon the Covering, and are in a perpetual Agitation, either to give Warmth to the Eggs, or at least to repel the Cold from them. When the Worms leave the Eggs, they endeavour to break down the Door of their Lodge; the Bees without, assist them by rubbing the Wax, and making it soft, and then comes a large Bee, who destroys all the waxen Covering.

Cher. What, does he live upon Wax?

Prior. No, Sir; but he melts it in his stomach, which is very hot, and then employs it elsewhere in some other Work. The Worms that are hatched

fall into Convulsions which moisten them all over with Sweat, and what then transpires thro' their Body, forms a Glew that gradually hardens and becomes a little white Skin, which immediately enfolds them. This is their State of Nymphs, and they then look like so many Grains fasten'd to one another, and which, all together, form a little Cluster. After this, out of each Nymph's Shell proceeds a little Bee, who begins to rub his Eyes with his Fore-paws. His Wings, that are still spread on his Back, and moist, grow dry in the Air by degrees; and in the Space of a Quarter of an Hour he springs aloft, and immediately attempts to fly at a Venture with those of his own Age. The young ones are, for some time, permitted to sport as they please, and all the little Bees do nothing for the three first Days, but flutter up and down, and interrupt the Work of the larger Insects, who at length begin to be weary of these wanton Liberties, in consequence of which they chase away the little Offspring, and bring them down to the Ground; upon which the young ones, after they have turned round a considerable time, as if they were intoxicated, begin to work in their Turn, and carry Earth to the Nest.

to sustain the Sheets of Wax that form the Vault. This Earth they cement and spread out with a retrograde Motion of their Bodies over it. The old ones work in Wax, and the Young only perform the Functions of Masons Servants.

Cher. Have not the wild Bees a King, as well as the domestick Tribe?

Prior. I have certainly seen, amongst mine, and that very frequently, a large Insect, much superior in Size to the rest, and without Wings or Hair; it was as bare as a plucked Fowl, and black as Jet or polished Ebony. This King goes from time to time to survey the Work; he enters into each particular Cell, seems to take their Dimensions, and examine whether the Whole be finished with due Symmetry and Proportion.

Count. I am not certain, Sir, whether you have sufficiently considered this Circumstance, or not; for I am very apt to suspect this Monarch to be Queen, and that her Visits to each Cell, only tend to deposite her Eggs there.

Prior. I readily confess my Inaccuracy in this Particular, and you are much more exact and attentive than myself, in all your Observations. But,

however, I will proceed in the Account of what I think I have seen, and beg the Favour of you to rectify whatever may lead the *Chevalier* into a Mistake. When this King makes his Appearance, all the Bees who present themselves in his Way, form a Circle a-round him, poising themselves on their Fore-feet, and after several Leaps and Curvets, attend him thro'out his Progress; at the Conclusion of which the King retires, and all the rest return to their Employment; but these wild Insects are far from devoting themselves to Labour, with the same Vigour and Affiduity that the common Bees discover. In the Morning, the Young appear indolent, and are with great Difficulty brought to apply themselves to their Functions; but, in order to rouse them, one of the largest of the Band, every Morning at half an Hour past Seven, extends one half of his Body out of a Cavity contrived for that Purpose, and seated on the most elevated part of their City; there he claps his Wings for the Space of a Quarter of an Hour, and with the Noise awakens all his People. This summons them to work, and is the Drum that beats the Signal for their March. And I have frequently obliged my Fraternity to take notice

of this kind of Discipline, which exceedingly diverted them. There is likewise another, who keeps guard all Day, and I have seen him acquit himself of his Commission with a Vigilance that astonished me. When I have struck the Hive a little harder than ordinary, the Centinal immediately quitted his Box, and with an Air of great Uneasiness and Emotion, mounted to the Top of the Vault, running here and there to discover what might occasion the Alarm ; and when he has satisfied himself that no Danger or Enemy was near, he returned to his former Post. I have sometimes thrown a common Bee into the Hive, after I had plucked off one of his Wings ; but he was instantly seized by the Centinel, and kill'd upon the Spot.

Chev. This makes the Account I have read in my *Virgil*, of the Guard kept by Bees, very credible. But what, Sir, is the Food of these wild Bees ?

Prior. They eat a kind of Honey, but then 'tis inferior in Purity to that of the domestick Bees, because they extract it from Flowers that grow wild, and are impregnated with Juice of a bitter Flavour.

Chev. Do they store up any Provisions ?

Prior. Just as the Bees do; and for that Purpose they employ the Cells out of which the Worms proceeded: These they fill with Honey, and then close them up carefully with Wax. They are burden'd with a number of Sluggards, and 'tis, probably, against them that they use this Precaution.

Count. But in what Instance, Sir, did you discover their Idleness?

Prior. In this. When the rest of their Companions have been employ'd in the Fields, I have observed these roving at a little Distance from the Hive. They give themselves the Air of working a little, and then return Home and eat, without having done any thing material.

Count. Your being so much accustomed to see bad Actions in others, makes you suspicious. But these Sluggards you mention, seem to me to be the Males, as there are such among the Bees; and they are nourished for a Season in Requital of their past Service but when Winter comes on they are probably, sent away to provide for themselves elsewhere.

Prior. What your Lordship says, appears very probable; and I see no Reason why the wild Bees should not, as well as the others, have their Queen

their

their Males, and likewise a whole People without distinction of Sex. But this is a Point that requires farther Examination.

Count. Let me beg the Favour of you, Sir, to proceed in your Observations on what passed in your Hive. All this is new to me.

Prior. Ah, my Lord ! my Observations are all at an end, for we met with a very great Accident.

Chev. Pray what was that?

Prior. Four Days ago, our Queen came out very early in the Morning, and all enfeebled with Age, proceeded with a trembling March to the Confines of her Dominions. I saw her lie down behind a little Eminence ; and after she had languished a few Moments ———

Chev. What happened ?

Prior. She breathed her last, and all the City was in Desolation. The Drum did not beat the Signal that Day, and nothing was to be seen but a general Grief and Dejection.

Chev. The Curate makes me sympathise in their Affliction. But what might be the Event ?

Prior. It was natural for great Disorders to ensue in the State ; the Number of Inhabitants, since that time, has continually diminished, and they are daily

daily removing in quest of a new Settlement. The Day before Yesterday, there was a very fierce Battle; and one Animal, more enterprizing than the rest, lost his Head; I saw him run without it to the Top of the Vault where he did not expire till this very Day. All Order was at an End; the Morning Signal was no more repeated; no Centinel made his Appearance and the regular Labours were intirely discontinued.

Chev. I am not at all concerned at the Execution of the Malefactor, for I think he makes a very entertaining Figure.

Prior. My Insects are all disconcerted and I believe very few of them are now left. If the Count will trust the *Chavalier* in my Company for an Hour or two, I will shew him the Structure of the Nest.

Count. Do something more: If there are no Stings to be fear'd, take out the Nest, and send it to me; or rather, let us resign our Pretensions to the *Chavalier*. It will contribute to the embellishment of his Cabinet, and may be hung up with his Wasp's Nest.

Countess. Gentlemen, you have now yet discharged all your Province; you have had a good Account from you

the Industry of Bees ; but you have not been particular enough in the Use we make of their Labours, and I must ask the *Prior* how far these are capable of being extended.

Prior. When the Seasons are not irregular, a Hive of Bees may be, every Year, worth a Pistol and more. If there should be two Swarms, the Profit will be double the next Year, tho you should destroy the first Bees with Sulphur, in order to take their Wax and Honey. They are never permitted to work above seven Years, because they grow feeble, and their Work is exposed to the Ravages of Worms, who in process of Time find out the Secret of sliding into the Skins with which the young Bees hang their Apartments. But I don't take upon me to give you a Detail of the Management of Hives. This is what may be learned from any common Gardener, and the Country-house of honest *Liebaux* is in the Hands of all the World.

Every one likewise knows the various Uses that are made, not only of Virgin Wax as it comes from the Hive, but of that sort too that has been first washed and then melted, and made white by exposing it alternately to the dews and Sun-shine. With this Wax they

they make, not only Flambeaux, Tapers, Images, and an hundred other Things that are well known, but they likewise employ it with great Success in anatomical Representations, that perfectly imitate Nature, and preserve those who have no Occasion to be deeply learned, from the Horror they are apt to be inspired with at the Sight of a Carcass, or Flesh in a State of Putrefaction.

The best
Honey.

The richest Lands don't produce the best Honey; there are some Soils not very luxuriant, that afford Fruits, Fowls, and each Variety of Game, and generally all Productions that have fine Juices, and a more exalted Flavour. And there the Honey is exquisite. Such, for Instance, is the Land about *Corbiere*, a few Leagues from *Narbonne*, and great part of *Champagne*. The Honey of these Countries is in the best Repute. There is one very peculiar Circumstance observed in the Canton of *Champagne* that lie contiguous to the Rivers, and are richer than the rest, which is this: The Bees make long Excursions into the neighbouring Countries, and prefer the Flowers they find in dry and steril Soil, to those that grow in the very Fields where these Bees were rear'd. A Gentleman who lives near

the River *Aine*, and whose Company I enjoy'd one Day in a Journey from *Chalons* upon the *Marne* to *Charleville*, furnished me with this Observation. We were about a League and an half from his Estate that lies in the *Vallage* on the Edge of the lovely Meadows of *Attigny*; as yet we saw nothing but Heath, and could not discover any Village for above a League in Circumference. Do you take notice? said he, shewing us a Crop of Buckwheat, that refreshed us with a very agreeable scent, Do you take notice of my Servants that are dispersed about the Country? they are all at work for me. But perceiving that we did not comprehend his Meaning; this is the whole Mystery, continued he, those Bees that are buzzing about the Corn Flowers, come hither from a Distance of two or three Leagues. We daily see them forsake our Gardens, and take their Flight over the Meadows, despising the Oil and Fertility of our Vallies, in short they continue their Progress to the Mountains and Plains of *Champagne*, where they find Lavender, Thyme, Sweet Marjoram, Buckwheat, and several other Plants very little cultivated, but of a most delicate Sap. You will find Bees all the way from hence to my Estate, and some curious

curious Observers are persuaded they have seen them, thrice in one Day, take a Journey of a League and an half, or two Leagues, to furnish their Table to their Palate.

Countess. Chevalier, these Gentlemen are at the Expence of our Conversations, but as poor as you and I may be, I think in point of Honour we should endeavour to furnish our Proportion, and bring each of us, the History of some Insect To-morrow.

Chev. I have made my Court to the *Prior*, who has a Magazine of Curiosities, and I purpose not to come with empty Hands To-morrow.

The End of the Seventh DIALOGUE.

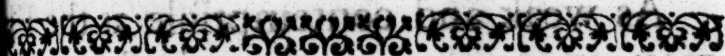
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F L I E



FLIES.



DIALOGUE VIII.

The Count de JONVAL.

The Countess de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Countess.



Ray, Gentlemen, let us know our Riches before hand, and see what each of us contributes to this

Ray's Entertainment.

Count. You will have nothing from me but a Fly and a Gnat.

Prior. I intend to give you the Gril-
calpa, or Mole Cricket, and the Ant.

Chev.

Chev. And I the Formicaleo or Lion Pismire, a most terrible Enemy to the Ants.

Count. Here are Materials enough for one Entertainment, and I may reserve my Part for another Day. When one is not rich, OEconomy is very convenient.

Count. Let us begin with the common Fly.

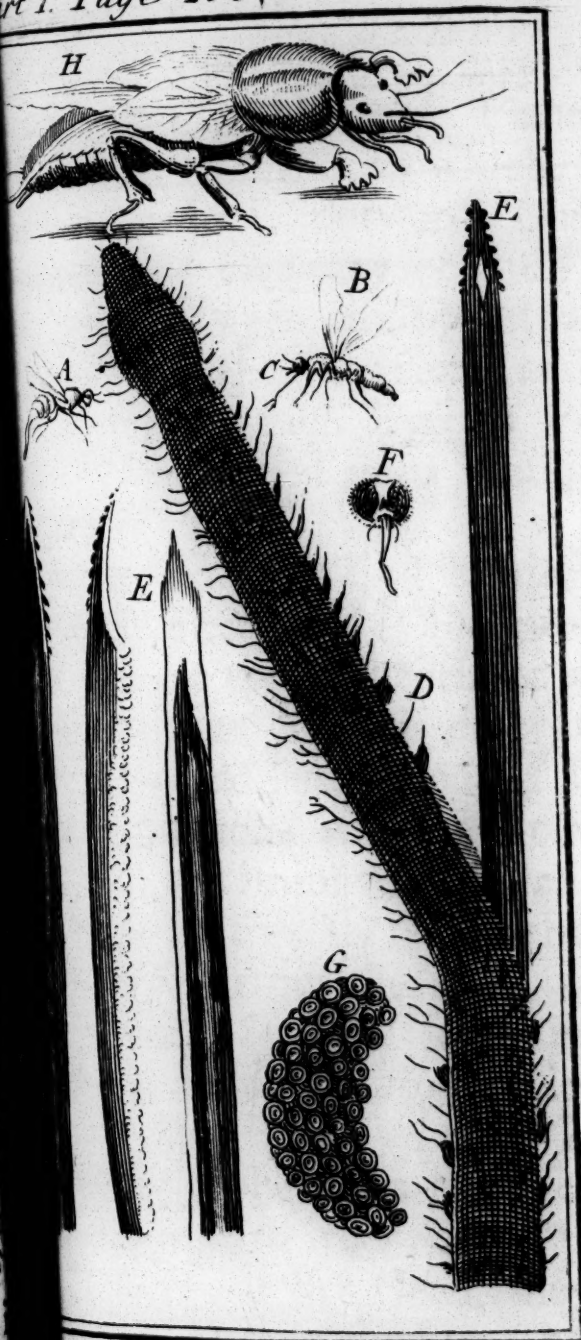
The common Fly.

As weak and contemptible as the Fly may appear to us, there is scarce any Species of this Insect, but what is furnished with five or six Advantages that are perpetually serviceable to it in all its Necessities. For Instance, it has excellent Eyes, it has likewise Wings, Claws, Sponges, a Trunk, and a Piercer.

Its Eyes.

Its Eyes, as well as those of Beetles and Dragon-Flies, are of a peculiar Structure: They are two little Crescent or immoveable Caps, disposed round the Head of the Insect, and comprehending a prodigious Number of minute Eyes, or crystalline Humours, ranged like Lentils, in Lines crossing each other in the Form of Lattice Work *. Under these one may discover a Set of Fibres, or optick Nerves, corresponding in Number to the external Divisions

* Leeuwenhoek Arcan. Nat. Tom. iii. Ep. 11.
Nieuwentit. Exist. liv. 2. c. 7.



Glow-worm w.th the Piercer in the Tail exten-
the Gnat Cher Sting D. the same Sting at Large
Swords conjunctly and Separately exhibited
head of a common Fly w.th Trunk projected
for the Suction of Liquors &c. The Eyes of a Beetle
Millotalpa Cricket.



little Planes, and curious Observers will tell you they have counted several thousands in each Combination †. But whatever the Number may be, it is certain ‡ that all these Planes are a Collection of Eyes, on which, as on so many Mirrors, outward Objects are painted. || One may see the Figure of a lighted Taper multiplied almost to Infinity on their Surfaces, and shifting its Beams into each Eye, in Proportion to its being varied in its Motions by the Observer's Hand.

Cher. To what End is this Prodigality of Eyes bestowed? The generality of Animals are very well satisfied with two.

Count. The Eyes of other Creatures are multiplied by Motion, if I may use that Expression; whereas those of a Fly are fixed and immoveable, and can only see what lies directly before them; they are very numerous therefore, and placed on a round Surface, some in a high, others in a low Situation, to inform the Fly of every thing wherein she can be interested. She has a Number of Enemies, but with the Aid of these Eyes that surround her Head, she discovers whatever Danger threatens her from a-

† Eight thousand at least, according to *Leeuwenhoek's* *Experim. and Contempl.* Ep. 83.

‡ *Leeuwenhoek, ibid.*

|| *Observations de Puget.*

bove, behind, or on either side, even when she is in full Pursuit of a Prey that she sees directly before her; and the same Object is as distinctly perceived by that Profusion of Eyes, as it is by us who behold it with no more than a Couple.

The
Wings and
Claws.

The
Sponges.

The Wings that convey the Fly where she pleases, and the Claws that fix her in any Situation she likes best, are Advantages she enjoys in common with the generality of Insects; but she has one almost peculiar to herself, and that is, a Packet of Sponges, placed at the Bottom, or about the Joints of her Claws and which, when she marches over a polished Body, to whose Surface her Hooks can't fasten her, she squeezes and forces out a liquid Glew, that sufficiently fixes and preserves her from falling. These Sponges may contribute to soften her Steps and preserve her little Claws, that without this Relief would be soon worn out. Besides these Sponges her Paws are shaded with a Growth of Hair, that she employs instead of a Brush, to clean her Wings.

Chev. I have been sometimes very much delighted to see her perform this Piece of Exercise. She first cleans her Brushes, then rubs one Paw against the other, and afterwards draws them, first over her Wings, and then under; concluding

cluding the whole with brushing her Head. But what Occasion has she to repeat the same Work so often?

Prior. Cleanliness is her indispensable Care, and she knows, that were it not for this Precaution, Dust and Smoke, as well as Rain and Fogs, would settle on her Wings, and incumber her delicate Body. But we interrupt the *Count*.

Count. Her Trunk is composed of ^{The} two Parts, one of which folds over the ^{Trunk.} other, and both of them are sheathed in her Mouth. The Extremity of this Trunk is sharp like a Knife, to enable her to cut what she eats. She likewise forms it into two Lips, that she may the better take up proper Quantities of Food; and when she sucks up the Air it contains, she employs it as a Pump for drawing up Liquors. Several Flies, at the other Extremity of their Body, are furnished with a Piercer *, above three ^{The} twelfths of an Inch in Length, with ^{Piercer.} which they penetrate wherever they please, and then sheath it between their scales. This Instrument consists of several Parts, as, particularly, one or two jaws finely pointed at the End, and well indentured thro' the whole Length, a long case to enclose them, a System of Mus-

* Leeuwenhoek's Arcan. Nat. Tom. iii. Ep. 136.
and Tom. ii. Ep. 64.

cles to unsheath them, and a Set of Fibres to bring them back to their Socket. Its last piece of Furniture is a Bottle of corroding Water, to eat into the Cavities that have been first opened by the Saws.

With this Piercer the Fly digs a Repository for her Eggs, and generally makes choice of a succulent or milky Substance, scarcely salted at all, because the sharp Particles of Salt are more apt to tear the tender Organs of her Young, than contribute to their Preservation. From these Eggs proceed a Brood of Worms that wrap themselves in a fine Web, change to Aurelia's and then to Flies. I omit the Consequences of their extreme Fecundity and shall only observe that neither the Lion's Throat, nor the Wolf's Teeth nor all the Horns and Fangs of wild Beasts, in their united Rage, are so pernicious to Man as this little Piercer that Nature has bestowed on a common Fly to dig a Repository for her Eggs. The Case is not the same with shining Flies and several other Species; for they are in some measure, beneficial to us. The generality of these Creatures sustain and shelter themselves in some particular Plant, and it is to their Solitude that we owe the Invention and Materials of the

fine

finest Colours used either in Dying or Painting, as also the deepest Black, common Ink, Scarlet, Vermilion, and many more.

Countess. I have always heard that Ink was a Composition of Vitriol, and Gall-Nuts gather'd from Oaks, and that the scarlet Dye was produced from Cochineal, which, as People say, is only the seeds of a Tree in the *Indies*: And I don't in the least comprehend, what Use can be made either of shining Flies or their Piercer.

Count. 'Tis this: There is a Species The Origin of the Gall Nut. of Flies * that chuse to deposite their

eggs in the Oak, preferably to any other Tree, and, with the Instrument I have been describing, pierce into the heart of a Leaf, and frequently to the end itself, whilst it is yet tender, and when with their Saw they penetrate to the very Pith. At the same time, she injects into this Cavity a drop of her corroding Liquor, and immediately lays an Egg, and sometimes several, there. The Heart of the Bud being wounded in this manner, the Circulation of the nutritious Juice is interrupted, and, by the Mixture of the Poison infused by the Fly, is thrown into a Fermentation and Effervescence, that burns the conti-

Malpighi de Gallis.

P 3

guous

guous Parts, and there changes the natural Colour of the Plant. The Juice or Sap, turned from its proper Channel, extravasates and flows round the Egg. After which it swells, and is dilated by the Spring of several little Bubbles of Air that enter thro' the Pores of the Bark, and float in the Vessels with the Sap; its Surface is dried by the external Air, and hardens in a Form that resembles the bending of a Vault, or the roundness of a Kernel. This little Ball gradually receives its Nourishment, Growth and Vegetation like the Root of the Tree, and is what we properly call the Gall-Nut.

The Worm that is hatched under this spacious Roof, finds, in the tender Substance of the Ball, a Sustenance accommodated to its Nature; it eats and digests it, till its Transformation, first into a Nymph, and then into a Fly, after which, finding itself furnished with all its Equipage, it pierces thro' the Inclosure, and launches into the open Air.

You may easily be convinced of the Truth of this Account; examine the Gall-Nuts that grow at the beginning of Summer, and you will immediately see them pierced thro'; because the Warmth of the Season has advanced

the Egg, the Nymph, and the Fly, to Maturity. If, when you open them, you should find a little Spider there, don't imagine she came from the Egg of a Fly; for when this Insect quits the Gall-Nut, the Place does not cease to be useful; a small Spider generally slides into the Cavity, and finds a Space already prepared for her Habitation, and there spins her Web in proportion to the Dimensions of the Cell, and ensnares the minute Insects that venture into her Territories.

But the case is not the same with the Gall-Nut that grows in Autumn. The Cold frequently comes on before the Worm is changed into a Fly, or before the Fly can disengage itself from its Confinement. The Nut falls with the Leaves, and I suppose you imagine the inclosed Insect to be destroy'd; but the Fact is quite otherwise, and her very Covering contributes to her Preservation. In this manner she passes the Winter, well lodged and calked up in the Shell of the Nut, and even buried under a Heap of Leaves that preserve her from all Injury. But this Mansion, that proves so commodious in the Winter, is a Prison in the Spring; and the Fly, awaken'd by the first Heats, opens herself a Passage, and expatiates in full
P 4 Liberty.

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P 4 Liberty.

Liberty. A small Aperture suffices her, because at this time her Bulk is very inconsiderable, and besides this, the Rings that compose the Body lengthen, and become pliable in her Passage.

Chev. Your Lordship enables me to comprehend the Reason why we find a Worm under the hard Shell of a Filberd, or Small-Nut. It proceeds from an Egg left there by a Fly, when the Fruit was tender, and one always sees the Orifice made by the Piercer, thro' which the Insect injected her Egg.

Count. If this Orifice should be closed up as it is in Fruits, Peas and Beans, it is because the Flow of the Sap into the Wound stops it up by degrees. The Worm, when she forsakes the Egg, finds in the Hollow of the Kernel, or the Heart of the Fruit, a Solitude where nothing can incommode her, and has also a Supply of Provisions in whose Property she has no Competitor. She works there with her Teeth and Feet in full ease, and thrives to Admiration, till finding her Wings unfolded, the love of Liberty and Pleasure prompts her to make an Opening in the Wall, and then she sallies out to seek Company.

Chev. You make this solitary Act a very pleasant Part.

Countess.

Countess. This Explication of the Original of a Gall-Nut frees me from a Perplexity. I was in Pain to know whether the Oak that produced the Acorn, did not likewise bear another kind of Fruit of a very different Nature; but I am now convinced that these Nuts are no more than Excrescencies, occasioned by the Puncture made by an Insect.

Count. They are called Nuts without any manner of Reason. It is true, they have something like a Kernel, and are gathered from a Tree; but then they have only a false Appearance of a Nut or Fruit, without being either the one or the other. There is hardly any Plant but what is pierced in the same manner by some Insect, and which produces some of these pretended Nuts of all Sizes and Colours. Some Trees have their Leaves intirely crusted with them, but they are not called by any particular Name, because they are never used; but it is possible that those which grow on the Plane Tree, the Poplar, the Willow, the Box, and the Ivy, would afford very rich Colours, were People disposed to make the Experiment.

Countess. Is it not the same with Cochineal as it is with the Gall-Nut?

Count.

Count. Cochineal is neither a Fruit, nor a Gall-Nut formed by the Puncture made by an Insect *, but it is the Insect itself that pierces the Cochineal Tree. This Plant, which in *New Spain* is called the *Nopal*, is a Species of the Fig-Tree ; the Leaves are thick, full of Juice, and thorny. The Inhabitants that cultivate it sweep from the Leaves, at the approach of the rainy Season, several little Insects, or a kind of Bugs, that suck the Green Plant. They preserve them in their own Houses, and nourish them with the Branches of the *Nopal*. When they are grown strong, and the Rains are over, they put twelve or fourteen of them into little Panniers made of Moss, or the Down that covers the Cocoa Nut. These Panniers they place on the *Nopal*, and the Cochineal Insects, in a few Days, give Birth to an infinite Number of Young. The Dams live but a little time after they have laid their Eggs, and are what may be called the first Produce. The Young forsake the Panniers, and disperse themselves over all the Verdure of the *Nopal*, and thrive to that degree in the Space of three Months, as to be prolifick in their Turn. The second

* Hist. Nat. de la Cochenille verifiée par les attestations des Juges de la Province d'Oaxaca, Amst. 1729.
Brood

Brood are permitted to live, but all the Parents are carried home and killed; the new Offspring on the Tree have likewise their Young at the End of three or four Months; but, lest they should all be destroy'd in the rainy Season, the Inhabitants carry home the Parents as well as their Offspring; and this is the third Produce. A sufficient Number of the young Insects are preserved to continue the Species the next Year, and all the rest are killed in hot Water, or Ovens, or upon flat Stoves where the *American* Women bake their Bread. The Insects † that are destroy'd in hot Water, are of a brown Colour inclining a little to red; those that are killed in the Oven, are of an Ash Complexion and streaked like Marble; and such of them as expire on the Stove are black, and seem burnt. Their Inside is filled with a beautiful red Powder. These Insects are sent to us dried, and half reduced to a Powder, in which, without the Assistance of a Microscope, one may distinguish an oval Body, Scales and Paws, or little Pieces of them bruised, and a small pointed Trunk. The true Vermillon, or Lack, Kermes, and a Variety of other valuable Colours, or Drugs, have no other Ori-

† Hartzoek Essai de Diopt. p. 52. Paris 1694.

ginal than the Punctures of different Insects*; our Plants are covered with them, and perhaps we go to the *Indies* for Commodities that are every Day presented to us at home.

Chev. We are charmed, my Lord, with your Flies; but are the Gnats too as curious in their Kind?

Count. Their Usefulness perhaps is not so great, but their Transformations are more extraordinary. Let us take a Turn along the Mote of the Castle. I have discovered what we want. Stoop down a little, *Chevalier*, towards the Root of that Tree which shoots into the Water. What do you discover on the Surface of the Water, close by the Root?

Chev. I see something like a little Sieve, fasten'd at one End to the Stump of the Root.

Count. That Sieve is a small piece of Glew sustained by the Water, and the pretended Holes of the Sieve are Eggs properly ranged upon the Glew †, to prevent them from sinking; and the Fastening which joins it to the Root preserves the whole from being carried away by the Winds, to any other Situation.

* *Memoirs de l'Acad. des Scienc. M. Geoffroi, le Jeune, 1714.*

† *Hist. des Inf. par Swamm.*

tion that might prove too cold, and where the Eggs for want of the Sun-Beams could not be hatched.

Chev. What Animal has taken all these wise Precautions?

Count. 'Tis the Work of Gnats, who are so well known by their Buzzing, and sharp Stings.

Chev. How! does the Gnat, that lives upon the Earth and in the Air, lay her Eggs in the Water?

Count. Have you not frequently seen Gnats flickering along the Surface of standing Waters? They are fond of that Neighbourhood, because there they rear their beloved Family. I grant there are other Species who seem to be born in Woods, and probably at a great distance from the Water; but I will give you the History of those that have come to my Knowledge, in a few words.

From the Eggs strew'd over a Bed of Glew, on the Edge of the Water, proceeds a Brood of little Animals that pass thro' three different States. They are first, Inhabitants of that fluid Element; they then change from aquatick, to amphibious Creatures, living both in the Air and Water; and at last confine themselves intirely to the Air.

In their first State they are Aquaticks, ^{Their three States.} in which Period they wear the Form of minute

minute Worms, and make themselves little Lodgments of Glew, which they fasten to some solid Body at the very Bottom of the Water, unless they meet with any Chalk; which being more pliant and soft, permits them to sink a Habitation in its Entrails; where they are defended from the Teeth of Fishes, but not from the Claws of Cray-Fish.

This Worm, in process of time, is divested of its Form, and acquires a large Head, and a Tail shagged with Hair and moisten'd with an oily Fluid, that like a Cork assists her to sustain and transport herself from place to place; her Head raised in the Air, and her Tail sliding on the Water. If the Oil with which her Tail is lubricated begins to dry up, she discharges an unctuous Humour out of her Mouth, and sheds it over her Tail; this restores it to its Faculty of steering her where she pleases without being moisten'd or prejudiced by the Water.

The Gnat in her second State, is properly in the Form of a Nymph, which transfers her to a very different Condition of Life: She immediately disrobes herself of her second Skin, resigns her Eyes, Horns and Tail; but from the Ruins of the amphibious Animal a little winged Insect springs into the Air with

with a Body actuated by a surprizing Agility, and constituted with the finest Texture of Limbs. The Head is beautified with a delicate Plumage, and all the Body invested with Scales and Hair, to defend it from Humidity and Dust. She tries the Activity of her Wings, by rubbing them against her Body, or two Bags that hang at her Sides to poise her in an Equilibrium. The Furbelow of little Plumes that border her Wings, are admirable in their kind.

But nothing is more precious in the Equipage of a Gnat than her Trunk,^{The Trunk.} and one may venture to say, that this feeble Instrument is one of the greatest Wonders of Nature; it is so extremely minute, that the best Microscopes hardly give us a View of its Extremity*. What is first discoverable, is a Case composed of long Scales which she carries under her Throat, and which at about the distance of two Thirds of its Extent, has an Opening thro' which she launches four Darts, and then returns them into their Quiver: One of these Darts, as pointed and active as it performs the Office of a new Case to the other three which are there sheathed in a long Groove, and have their Sides

* Leeuwenhoek's Arcan. Nat. Exper. & Cont. p. 69.

sharpen'd like fine Swords; they are likewise barbed or thick set, with cutting Teeth towards the Point, which is a little hooked, and whose Fineness is inexpressible. When all these Stings are darted into the Flesh of Animals and make their Wounds sometimes one after another, and sometimes in Conjunction, the Blood and Humours of the adjoining Parts must unavoidably be forced out of their Vessels, and cause a Tumor in the Incision, whose little Orifice is closed by the Compression of the external Air.

When the Gnat, by the Extremity of her Sheath, that serves her instead of a Tongue, has found out any Fruit, Flesh, or Juices that she has been seeking; if it happens to be a Liquor, she sucks it up without ejecting her Lances; but if she meets with Flesh that resists her Efforts, she stings very severely, and then sheaths her Weapons in the Scabbard which she applies to the Orifice of the Wound, and thro' the Cavity draws up the Juices she finds there.

This is the Instrument with which the Gnat is accommodated for her Summer Work, but in the Winter Season she is released from the Care of getting Provisions; for then she ceases to eat, and passes all that melancholy Season

Season in Caves and Quarries; which, at the Return of Summer, she forsakes, and takes her Flight in quest of a standing Water, where she may have an Opportunity to perpetuate her Family, that would soon be hurried away by the Rapidity of a running Stream. The little Progeny are sometimes so numerous that the very Water is coloured according to the Complexion of the Species. When they are green, it exhibits the same Tincture, as it deepens into a sanguine Dye when the Insects happen to be red. 'Tis now the *Prior's* Turn to favour us with an Account of the Grillotalpa.

The Form of the Grillotalpa.

Countess. The Sound of that hard Word shocks my Ear, why don't you give it the Air of our Language? Is not this the Animal I have seen in your Closet, stretch'd on a green Turf, and covered with a little crystal Bell? The creature is near three Inches long, has two Horns before, and as many behind, give it Intelligence of all that passes amidst the Darkness she resides in; and besides this, has a couple of strong short Wings, and two that are very long; a large Coat of Mail on her Back, and two Arms fortified with a couple of dreadful Saws?

Count. 'Tis the very same.

Q

Countess.

Countess. I think I have heard it call'd a Mole-Cricket ; because it lives under Ground like a Mole, and imitates the Chirping of a Cricket ; and this is the Name I would chuse to give it.

Prior. The Ladies have a greater Privilege than our Sex, in the Use of new Words. Her Ladyship's Authority may give a Currency to this Term, and we will trust to the Event.

Count. With the *Prior's* Leave we will walk to a Corner of the Parterre, where you will find a Nest of these Mole-Crickets. You see I have Intelligence of all that passes here. Each Tribe of Animals is at work for me. This is the Place.

The Nest
of Eggs.

Prior. Let us take a Spade, and shew the *Chevalier* a Clod of Earth cemented and covered with Turf, in the Heart of which he will find * a little Apartment, capable of containing two Filberds, and there all the Eggs are lodged. Let us open it gently, and take care we don't break any thing. That, Sir, is the Turf I was speaking of, 'tis the Clod you see there as big as an Egg, and surrounded with a little Ditch. Take it up and cut it thro' the middle. You will see that the Entrance into the Chamber has been closed up.

* Godart.

Chev. 'Tis very true. What a prodigious Number of Eggs are lodged in the Cavity ! Let me count them. I find an hundred and fifty. But why are they laid there ?

Prior. Were the Eggs covered with the least Caution, or should the least Breath of Air be admitted to them, they would be destitute of the necessary Warmth, and the whole Posterity would be destroyed. Besides this, the Mole-Crickets are obliged to stop up, with so much Exactness, the Mouth of the Cell where they lay their Eggs, and to sink a Ditch all round it ; because there is a little black Animal a mortal Enemy to their species, who endeavours to devour their Eggs, and Young ; to prevent which, one of the Tribe perpetually keeps Centry on the Bank of the Ditch, and when the black Animal plunges himself in to seek his Prey, he is immediately cut short, and the Nest by this means is delivered from its Invader. If the Centinel finds himself assaulted by too many Enemies, he then throws himself in these winding Paths that you see struck out under Ground, and so evades the danger. But I am now coming to the most singular Piece of Dexterity we have observed in the Conduct of these animals, and which we discovered by

Q 2

the

the Assistance of a Glass Bell, under which we reared some of these Creatures in a Quantity of Earth sufficient to furnish us with our Observations.

At the Approach of Winter, the Mole-Crickets remove the Reservoir that contained their Eggs, and sink it very deep in the Earth, always taking care to dig it lower than the Frost can penetrate. When the mild Season comes on, they raise the Magazine in proportion to the Advances of that favourable Period, and at last elevate it as near the Surface as will be sufficient to make it susceptible of the Impression of Air and Sun-shine: And should the Frost return they again let it down to its proper Depth. The same Method is practised by the Ants, whose History I am now to give you, for I am not sufficiently acquainted with Mole-Crickets, to entertain you any longer on that Subject. But before I begin, I would ask the *Chevalier* whether we are to visit the Ants in the Quality of indolent Persons, for Instruction, or in the Capacity of Connoisseurs for Admiration?

Ants.

Chev. I understand you perfectly well Sir, and have been informed by the *Proverbs of Solomon* *, that the Id

* *Prov.* vi. 6.

ought to go to the Ants to learn how to be provident. Perhaps I am no Sluggard ; but yet, where is the Person that has no Occasion to be taught a prudent Forecast ?

Prior. The Sight of Ants is really very instructive. They are a little People united, like the Bees, in a Republick governed by its Laws and Politicks *. They have a kind of oblong City, divided into various Streets that terminate at different Magazines †. Some of the Ants consolidate the Earth, and prevent it from falling in, by a Surface of Glew with which they incrust it. Those of them that we commonly see, amass several Splinters of Wood, which they draw over the Tops of their Streets, ^{Their Streets.} and use them as Rafter to sustain the Roof; and cross these they lay another Rank of Splinters, and cover them with a Heap of dry Rushes, Grass and Straw, which they raise with a double Slope, to turn the Current of the Water from their Magazines; some of which are ^{Magazine.} appropriated to receive their Provisions, and in the others they deposite their Eggs, and the Worms that proceed from them.

Aldrovand. de Formicis. Jonston. Thaumaturg.

p. 356.

History of the *Buccancers* ; towards the End.

Q 3

As

Provisions.

As to the Provisions, they take up with every thing that is eatable, and are indefatigable in bringing home their Supplies. You may see one loaded with the Kernel of some Fruit, another bends under the weight of a dead Gnat. Sometimes several of them are at work on the Carcass of a *May Fly*, or some other Insect. What can't be removed they eat upon the Spot, and carry home all that is capable of being preserved. The whole Society is not permitted to make Excursions at random. Some are detached as Scouts, to get Intelligence and according to the Tidings they bring all the Community are upon the march either to attack a ripe Pear, a Cake of Sugar, or a Jar of Sweetmeats; and in order to come to this Jar, they leave the Garden and ascend to the third Storey of the House; there they find this Mine of Sugar, this rich *Peru* of Sweets that opens all its Treasures to their View but their March to it, as well as the Return from it, is under some Regulation. The whole Band is ordered to assemble, and move in the same Track but the Injunction is not executed with much Severity, and they have Liberty to expatiate when they have an Opportunity to spring any Game in the Countrey. The green Vermin, that with the Glo-

whi

which furrounds them make an infinite Waste among the Flowers, and cockle the Leaves of the Peach and Pear Trees, are a fine Regale for the Ants, and are the Animals they search for on the generality of Plants, before the Fruit comes to Maturity. These are the Vermin who are the Authors of all that Destruction to our Trees which is falsely imputed to the Ants, and draws upon them a very unjust and cruel Persecution.

The next prevailing Passion is to amass a Store of Corn, or other Grain that will keep ; and lest the Humidity of the Cells should make the Corn shoot up, we are told for a certainty, that they gnaw off the Buds that grow at the Point of the Grain.

I have seen Ants carry, and sometimes push before them, Grains of Barley and Wheat much larger than themselves ; but I never could find out their Granary. All the Ancients speak of it, and *Aldrovandus* assures us he has seen it. Their Labours, as well as their Inclinations, may vary according to their Species. 'Tis likewise probable that their Aurelias, which are sometimes yellow, have been taken for Grains of Corn without Buds, and swell'd by Moisture.

The Ants, after they have passed the Summer in a constant Employment and Fatigue, shut themselves up in the Winter, and enjoy the Fruits of their Labours in Peace; however, it is very probable, they are a little destitute in that Season, and are either benumbed, or buried in sleep like a Multitude of other Insects. And therefore their Industry, in storing up Provisions, is not so much intended to guard against the Winter, as to provide, during the Harvest, a necessary Sustenance for their Young. They nourish them as soon as they leave the Egg, with an Assiduity that employs the whole Nation; and the Care of their Young is esteemed a Matter of Importance to the State.

When the Young quit the Egg, they are little Worms no larger than common Grains of Sand *, and after they have for some time received their Aliment, which is brought to them in common, and distributed in equal Proportions; they spin a Thread, and wrap themselves up in a white Web, and sometimes one that is yellow; at which Period they cease to eat and become Aurelias. In this State some People fancy they are the Eggs of Ants when in Reality they are the Nymphs

* Leeuwenhoek's Arcan. Nat. Tom. i. & iii. Ep. 13

out of whose Ruins the new Pismires are to arise. Tho the Young discontinue their eating, their Nurture proves very fatiguing to their Parents. These have generally several Apartments, and remove their Young from the Nursery to some other Mansion which they intend to people. They either raise the Aurelias towards the Surface of the Earth, or sink them to a distance from it, in proportion as the Season is either warm or cold, rainy or dry *. They raise them when the Weather proves serene, and sometimes bring them out into the Sun-beams, or when a long Drought is succeeded by gentle Dews; but at the Approach of Night and Cold, or the Appearance of Showers, they clasp their beloved Charge in their Arms and descend with them to such a Depth, that one must then dig above a Foot into the Earth before those Aurelias can be discovered †.

We might enlarge on many other Particulars of their Conduct, such as their dispersing themselves over the Country, their Custom of removing the Dead from their Habitations, their Promptitude in assisting each other to carry their Burdens, or invade their

* Hist. Gener. des Insect. par Swamm. p. 162.

† Lowthorp's Abridgm. Tom. ii. p. 7. & 9.

Enemies; a long Description might likewise be given of the small Sting they carry in the Extremity of their Bodies, with a Bag of corroding Water that causes little Tumours. Much might be also said of their Wings that are acquired, by the Males, at a certain Age, to facilitate their Acquisition of Food, and which are refused to the Females*, that they may be more sedentary, and better devoted to domestick Cares; but the Subject the *Chevalier* has chosen for our Entertainment, is so extremely agreeable that it would be an Injury to the Company to deprive them any longer of so much Pleasure.

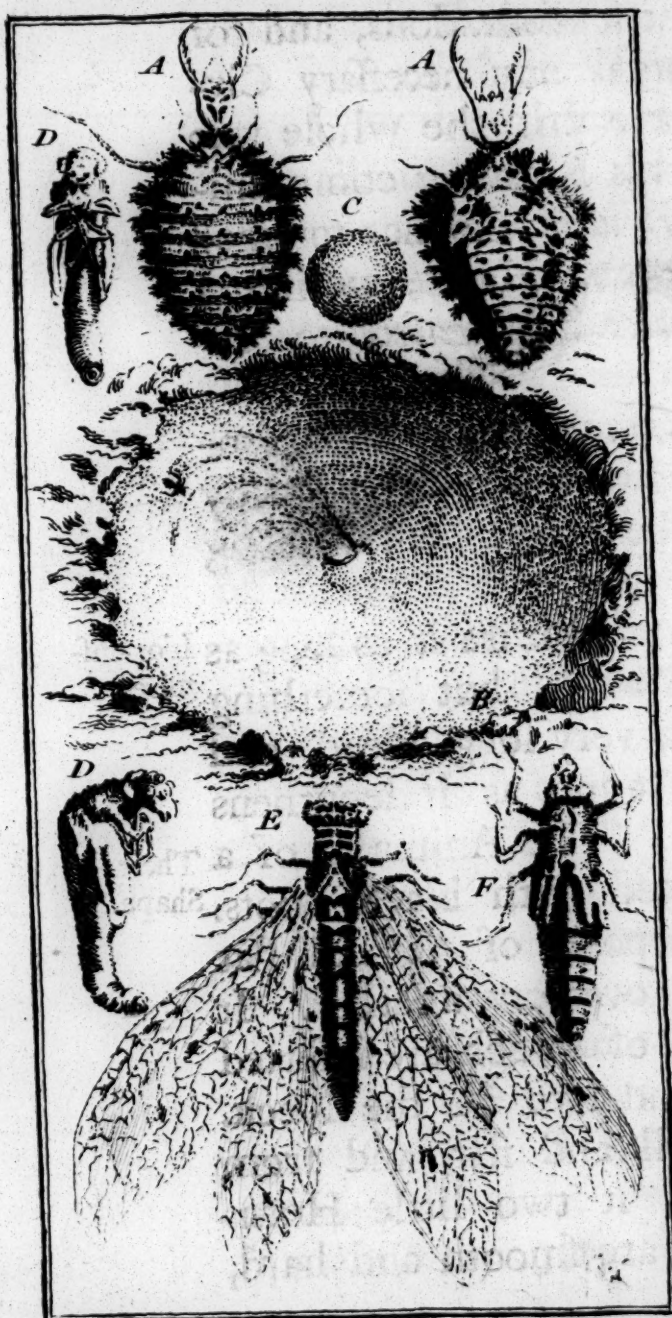
Chev. After the History of the Ant, the most natural Transition is to that of the Formicaleo, so called because it is the Lion, or most formidable Enemy to the Ant.

Countess. Rather call it the Lion Pismire. We are Masters of the Terms, at least in our Academy.

Chev. That Name is perfectly agreeable, and I shall never call this Creature by any other. I Yesterday saw a very pretty Picture of one of them in the *Prior's* Apartment, that represented all

* I think, however, that I have observed the whole Tribe of an Ant-hill furnished with Wings, and forsaking their Subterraneous Abode.





Part I. p. 235. F

A. Motte sc.

the Changes thro' which the Creature passes. I am tolerably well acquainted with the whole Train of Particulars *, but that I might not fatigue the Company with frequent Hesitations, and for fear I should forget any necessary Circumstance, I have put the whole into Writing, and this Morning communicated it to the *Prior*, who has touched it up with his own Hand; which I desire you would be pleased to remember.

Countess. The Gentleman delivers himself in such a natural Air as is worthy to introduce the most entertaining History.

Chev. The Lion-Pismire is as long as Lion-Pismires. the common Palmer †, but something thicker; it has a very long Head, and the Body grows round as it lengthens towards the Tail. The Animal is of a Their Shape. dark Grey marked with black Spots. Its Body is composed of several flat Rings, that slide over one another. It has six Feet, four of which are inserted in the Breast, and two in the Neck. Its Head is small and flat, and from the fore-part of it two little Horns shoot out; These are smooth and hard,

* M. Aubriet dessinat. au Jardin Royal.

† Memoirs de l'Academ. des Scienc. Monsieur Poupart. 1704.

extend

Instru-
ments.

extend two Twelfths of an Inch in Length, and bend like Hooks in the Extremity. Towards the Base of these Horns appear two little Eyes, very Black and lively, and which are extremely serviceable to the Creature, for he starts from the smallest Object he discovers. Other Animals are furnished with Wings, or Feet at least, to make them expeditious in the Pursuit of their Prey; but this is only capable of marching backwards. He never follows his Prey, and would sooner die than advance a Step towards it. The Prey must come to him, and he is gifted with the Secret of making it fall into the Ambuscade he has prepared. This is the only Method he has for his Subsistence, and is all the Science he is Master of, but however it suffices for his Purpose.

The
Ditch.

He chuses for himself a Bed of dry Sand at the Foot of a Wall, or under some Shelter, that the Rain may not disconcert his Work. He is obliged to make use of Sand, and of the driest he can get, because a solid Soil, as well as a moist Sand, would not prove tractable under his Operations. When he intends to hollow the Ditch where he ensnares his Game, he bends the hinder-part of his Body that tapers into a Point,

Point, and then plunges it, like a Plow-share, into the Sand, which he throws up in his Rear, with a backward Motion of his Body; and thus by repeating his Efforts, and taking several Rounds, he at last traces out a circular Furrow, whose Diameter always equals the Depth to which he intends to sink it. Near the Edge of the first Furrow he sinks a second, and then a third, and several others, which are smaller than the preceding, and sinks himself from time to time deeper in the Sand, which he throws aside with his Horns, on the Edges of the Furrows, and to a much greater distance, always marching backwards in a spiral Line. The repeated Strokes of his Head, whirl the Sand out of the Circle, and by degrees scoop out a Cavity, and in this Work he exceeds the best Engineers; he describes a perfect Circle, and traces out a Volute, without the assistance of a Pair of Compasses. He gives the Slope of Earth which he hollows, all possible Solidity. In this dexterous and indefatigable manner he compleats his Ditch, which resembles a Cone reversed, or rather the inside of a Funnel.

When this Creature is newly hatched, he opens a very small Ditch, but when he increases in Bulk, he digs one more spacious,

spacious, the Opening of which may contain two Inches or more in Diameter, and as many in Depth. When the Work is completed he forms his Ambuscade, and conceals himself under the Sand, in such a manner that his Horns exactly wind round the Point in which the Funnel terminates. In this Situation he watches for his Prey, and woe to the Ant, the Palmer, or any other Insect that is so indiscreet as to play round the Edge of this Precipice, which sinks in a Slope, and that too in the Sand, to give a Downfal to the little Animals that are too incautious in their Approaches. 'Tis for the female Ant that the Lion-Pismire thus adjusts his Kitchen. She is not aided with Wings, like the generality of Insects, to disengage herself from this Cavern, but then she is not the only Prey, for other Animals are also destroyed by the Dexterity of this Hunter. When he knows, by the Fall of some Grains of Sand, that a Prize is near, he shrinks back and moves the Sand, which immediately rolls to the Bottom with the Prey. If this Prey has Agility enough to be capable of remounting in an Instant, and with this Advantage is likewise assisted with Wings, the Lion-Pismire whirls a Quantity of Sand into the Air, above the
Heigh

Height of the Prey. This is a dreadful Shower of Stones to such a tender Creature as a Gnat, or an Ant. The unfortunate Prey, blinded and overwhelmed in this manner by the Tempest of Stones that pour down from every Quarter, and hurried away by the Instability of the Sand that rolls from under her Feet, falls between the Saws of her Enemy, who plunges them into her Body, drags her under the hands, and then feasts upon the Victim. And when nothing is left but the Carcass drained of all its Juices, he is particularly careful to remove it out of sight. The Appearance of a dead Body would deprive him of future Visits, and bring his Place of Residence under a bad reputation; he therefore extends his horns, and with a sudden Spring tosses the Slain half a Foot beyond the Ditch; and if this should happen to be disconcerted and filled up by such an Expedition, or if the Aperture become too large for the Depth, and the Declivity loses its proper Slant, he repairs the whole with all Speed; he rounds, he deepens, he clears the Cavity, and then catches for a new Prey.

An Hunter's Profession, they say, generally requires Patience, and the Lion-
His Patience.
mire has as large a Share of this Quality

Quality as he has of Craft. He sometimes passes whole Weeks and Months without Motion, and what is most surprising, without Food itself.

His Abstinence, which is very serviceable to him, is so extraordinary, that I have known him live above six Months in a Box exactly closed up, and where he had no other Accommodation than Sand. I have seen them complete their Work as usual, and then change into Nymphs like others which I have carefully nourished. 'Tis true, those who eat, improve both in Growth and Vigour.

When he has attain'd a certain Age, and would undergo a State of Renovation, in order to appear in his last Form, he then troubles himself no more with his Ditch, but begins to work in the Sand, and strikes out a Multitude of irregular Tracks, and certainly engages in this Labour in order to warm himself into a Sweat; after which he plunges under the Sand, and the viscous Humidity that flows from every part of his Body, fixes and unites all the Grains he touches. With these Grains, and the dried Glew that consolidates them, he forms a Crust that encompasses his whole Body, like a little Ball of five or six Twelfths of an Inch Diameter.

His
Tomb.

Diameter, in which the Animal reserves himself a competent space for Motion; but he is not satisfied with a bare Wall, which would inevitably chill him, he spins out of his own Bowels a Thread which in fineness infinitely surpasses that of the Silkworm, which we have so much admired. This Thread he fastens, first to one place, and then extends it to a second, still crossing and interlacing it: By this means he hangs all his Apartment with a Sattin tinged with the Colour of Pearls, and perfectly beautiful and delicate. In this Work all the Propriety and Convenience is confined to the Inside, for nothing appears without but a little Sand which confounds and incorporates the Mansion with the contiguous Earth. And now he lies secreted from the Pursuit of ill-disposed Birds; he rests in Oblivion, and lives in perfect Tranquillity; where he would infallibly be lost, were the outside of his Habitation ornamental enough to attract the View of any Creature whose Curiosity might prove inurious to him.

In this manner he lives, secluded ^{His} from the World, six Weeks or two ^{Change.} months, and sometimes more, and then divests himself of his Eyes, his Horns and Skin. His Spoils sink to the Bot-

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tom

tom of the Ball, like a Heap of Rags; all that now remains is a Nymph, who has other Eyes, and Paws, other Entrails and Wings enfolded with a second Skin, and hid in a nutrimental Liquor, that gradually strengthens the new Animal. When his Limbs have acquired their necessary Tone and Activity, he tears away the Tapestry of his Apartment, and pierces thro' the Walls; for which Purpose he employs a couple of Teeth like those with which the Grasshopper is furnished. And now he makes his Efforts, enlarges the Opening, thrusts out half his Body, and at last intirely quits his solitary Seat. His long Body, that winds like the Volute of an *Ionic* Capital, and possesses only three Twelfths of an Inch in Space, begins to unfold and extend itself, and in an Instant stretches to a Length of an Inch and three or four Twelfths. His four Wings that were contracted in little Folds and whose Dimensions did not exceed two Twelfths of an Inch, in the Film that sheathed them, begin to expand, and in the Space of two Minutes, shoot into a greater Length than the whole Body. In a word, the malignant Lion-Pismire assumes the Form of a large and beautiful Dragon-Fly.

who after she has for sometime continued immoveable, and astonish'd at the Prospect of Nature, flutters her Wings, and enjoys a Liberty she was unacquainted with in the Obscurity of her former State; and as she has cast off the Spoils of her first Form, so she is likewise divested of her cumbersome Weight, as well as her Barbarity and pernicious Inclinations. In a word, she appears intirely a new Creature, is all Gaiety and Vigour, graced at the same time with a noble and majestic Air.

Along the Edges of standing Waters one may find other Animals like this in Form *, but painted with Colours much more radiant and lively, and their Original is also very different. The Insect that arises from the Lion-Pismire, lays her Eggs in the Sand, that her young may be supplied with Food when it forsakes the Egg. Sand is no part of its Sustenance, but then it facilitates its manner of Life. The Creature immediately sinks a commodious Ditch, and in less than an Instant becomes completely skilled in Hunting and Geometry. The other Dragon-Fly that flutters along the Sur-

* M. Aubriet dessinat. au Jardin Royal.

face of Ponds, plunges the Extremity of her Body into the Water, and there lays her Eggs. The Animals that proceed from them, inhabit the fluid Element for some time; after which they assume a new Figure, and live upon the Earth in the Form of an Aurelia: But I am not sufficiently acquainted either with the manner of Life, or Transmigration of this last Animal.

Countess. I advise you to inform yourself of its History, for it must needs be very entertaining if it prove as agreeable as that of the Lion-Pismire; and you have my Thanks for chusing such a pleasant Subject.

Chev. This Compliment belongs to the *Prior*, for I am obliged to him for all my Materials.

Countess. I ought to acquit myself in my Turn; but what I have to offer may prevent the *Chevalier's* intended Walk; and therefore, I hope, you will give me Credit till To-morrow, and the Assembly, if you please, shall be held in my Apartment.

The End of the Eighth DIALOGUE



SHEL



SHELL FISH.



DIALOGUE IX.

The Count de JONVAL.

The Countess de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Countess. ET us walk in.



Count. To what Purpose, Madam, are all those Glasses so a-

greeably disposed?

Countess. They are a little Collation, that I have prepared for your Entertainment.

Count. The Liquor seems to be full of sediments, and I perceive these are Sea-muscles, laid on a little Bed of Sand in

the Water. Are we to have Muscles then, instead of fresh Oysters? The Regale is something new.

Countess. It is much better than your Lordship imagines, and I am very sure I shall have your Thanks for it. Do you see nothing besides the Muscles?

Prior. I see one quite open, and fasten'd with several Strings to a little Clod. One would be apt to take it for a Tent in Miniature, with all its Appendages of Cords and Stakes.

Count. I see two others that are likewise fixed to the Vessel with fewer Threads. This is something extraordinary, and her Ladyship certainly designs to shew us a Set of Spinsters.

Countess. That is the very Affair, and the Thought occurred to me when you entertained the *Chevalier* with the Works of Caterpillars and Spiders; they were Land Spiders, but there are others peculiar to the Sea, and I was very desirous to give you a Sight of them.

Chev. For once, Madam, you are out of your Province; this is neither your Garden, nor the Nursery of your Doves and Poultry.

Countess. Very true; but then it belongs to my Kitchen, Six or Seven

Days ago, my Steward paid the Ripier † for some Fish he had caught. I stopped a few Moments to observe a Heap of Muscles that had been delivered to the Cook, and was surprized to see several little Packets of Thread; upon which the Ripier, with the usual Politeness of those People, gave me to understand that the Muscles could not possibly be without it, and that it served them instead of a Cable, to keep them steady in their Mooring. This Information, I fancied, might produce something agreeable to you, and therefore I ordered him, when he came next, to bring me a couple of Stone Jars full of Sea-Water, with a little Sand, and some live Muscles upon it. He acquitted himself of his Commission very well, and came sooner than I expected. I distributed the Water, as well as the Sand, and Spinsters, into different Glasses, in order to observe the Event; and you may now see three or four of these Muscles at work. They certainly spin the Threads you see, and which were not there till Yesterday. With these Threads they fasten themselves either to some part

† A Ripier is one that brings Fish from the Sea-Coasts to the Inland Parts.

of the Vessel, or else to the Sand, by a natural Habit, and for fear the Water should wash them away; but how they make this Thread I can't possibly comprehend.

Count. Can you, my worthy *Prior*, distinguish any thing particular in the Work?

The Mus-
cle.

Prior. I observe, in the three first Glasses †, that the Muscle thrusts out of her Shells a kind of Trunk, or Tongue, with which she seems to be making Trials of the properest Places where to fix her Thread.

The
Tongue of
the Mus-
cle.

Count. I have heard that all Shell Fish of the same Nature with the Muscle, have a kind of Trunk, and I have frequently seen it even in those that have been boil'd. I know this Trunk performs the Office of a Foot and enables these Creatures to move; that they likewise extend it above an Inch and an half out of their Shells, and glew it to the Sand, but in what manner I am not able to declare; after which they immediately shorten it, and by this means move their little Habitation, and are capable of transferring it successively from one Place to another. But I per-

Their
Motion.

† Memoirs de l'Academ. des Scienc. Monsieur de Reaumur. 1711.

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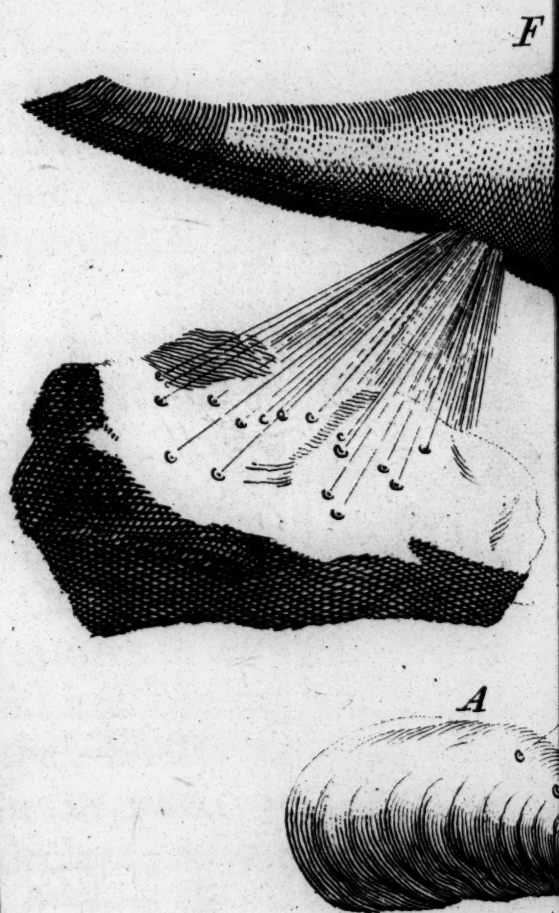
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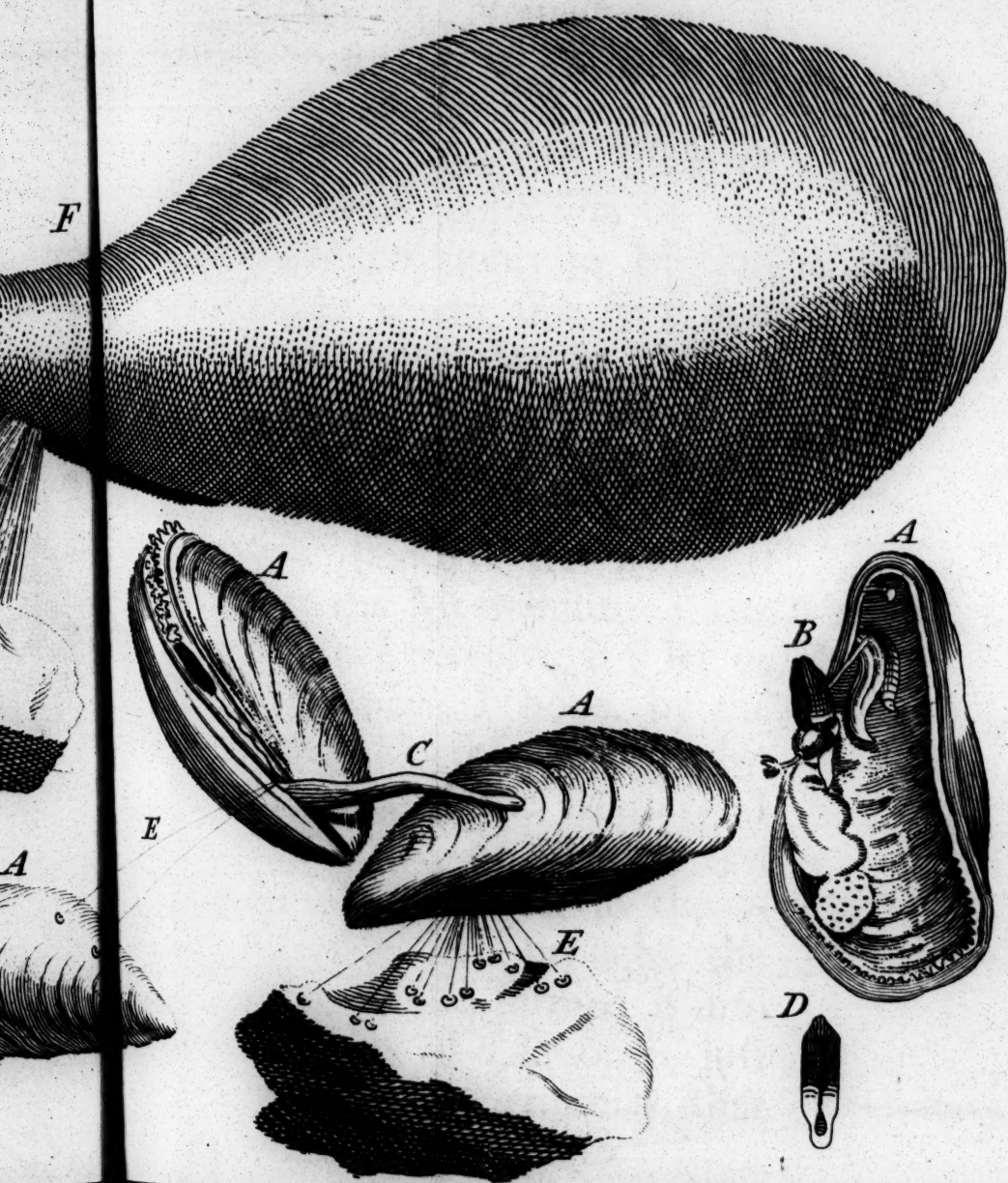
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A. Motte Sculp^t.

A. A Muscle. B. its Tongue. C. the Tongue forming a kind of Channel. E. fastens to some solid Body. F. The Pu



*C. the Tongue extended in order to find some firm Situation. D. the same
 Channel. E. the Threads which the Muscle forms with her Tongue and then
 The Pinna or large Muscle fixed by his Threads.*

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ceive this Trunk is serviceable to them in another Instance, and her Ladyship seems to have guessed it extremely well. It is not sufficient that the Animal finds Juices proper for its Nourishment, it must be able to fix there, in order to enjoy the Benefit of the Aliment; but, defenseless as it is, the first Blast of Wind, or the least Agitation of the Waves, that are commonly in Motion along the Coasts where she finds her Provision, would hurry her to a great Distance in an Instant; and therefore these Strings, in what manner soever they are made, were given her to fasten and keep herself steady. Let us see if we can discover the Mechanism of her Work. Methinks I perceive it; let us have a little Patience; I hope, by the Assistance of this Microscope, to give you a good Account of the Matter. I see a kind of Channel, or Furrow, run from one End of her Trunk to the other. The Muscle has brought the Sides of it together, and formed it into a Tube, and a Drop of Liquor is just now ejected out of the Extremity, that touches the Place she is fixed to.

Prior. That is very evident. The Drop has now assumed a round Form and begins to thicken.

The Thread.

Its Mechanism.

Count.

Count. I am apt to think, that the whole Trunk is as pliable as a thin Sheet of Lead, and rolls thro' its intire Length, into a round Form; whose internal Sides not being drawn so close together as to constitute a Solidity, a little Channel is left in the Middle, thro' which the Gum, that forms the Strings, is projected; and this Gum is shaped in the Cavity of the Trunk, like a Wax Taper in a Mould.

Prior. That must certainly be true, for you may now see all the Trunk unfold itself, and return to a Flat. The Liquor which is condensed in the Canal is disengaged from the Mould, by bringing the Tongue to its primitive Form; and you may now see a new Cord made, one End of which is inserted in the Stomach, from whence it proceeds, and the other terminates in the Substance to which it is fasten'd.

Count. It is plain the Animal is not yet sufficiently stiddy, for I see the Trunk extended a-new, and directed from Place to Place, in order to fix another Thread. Let us pursue her thro' all her Motions.

Chev. This is a Trunk that furnishes the Muscle with several Advantages: It is a Leg to assist her in her Progress; a Tongue to relish the Juices she tastes, and

a Mould to shape the Thread that is to fasten her.

Count. I begin to be persuaded that her Threads are in the manner we have represented, and can now comprehend how the great Sea-Muscle, which is a very large Animal, is able, with a finer Instrument, to form Threads more valuable than Silk itself, and with which the *Sicilians* make Stuffs of incomparable Beauty.

Chev. But here is a Difficulty. When the Muscle has eat, or sucked up all that is proper for her in one Place, how does she disengage herself? These Threads must then be inconvenient to her.

Count. The *Chevalier* reasons very justly; but I have not seen the whole Succession of this Piece of Work, and consequently have nothing positive to offer as a Solution of the Difficulty; but it is certain that the Muscles have a progressive Motion, and can transfer themselves from Place to Place. From whence I conclude, that as they have a Magazine of viscus Matter, with which they form their Threads, and fasten them at one End to a Stone, so Nature has also supplied them with a dissolvent Fluid, which they pour, as they have Occasion, on the Extremity of their

their Cords, or they have some other industrious Method of restoring themselves to Liberty, in order to fix up their Tent in another Situation. I should be glad to live at a less Distance from the Sea. It is another World that we are but little acquainted with, and by our Success in the Experience her Ladyship has procured us, I am persuaded one might make several curious Discoveries.

Countess. If we were to live near the Coasts that produce the large Sea-Muscles, instead of the Manufacturers of gross Thread, I would have shewn you a Set of Silk Spinsters; the Sight of their Work would have been an extraordinary Curiosity; but what Advantage may one derive from it?

Count. * I have seen Gloves of this Silk, they are made at *Palermo*, and 'tis not impossible to procure you some.

Prior. I have seen Gloves made of a very different Silk.

Countess. What Silk?

Prior. The Silk, or Thread of a Spider. The Gentlemen of the Academy at *Montpellier* sent them to be examined by the Academy of Sciences; and in a little time after, with the same

* *Memoirs de l'Academ. des Scienc.* 1710. p. 386.

Materials they wove Stockings and Mittens, that were presented to the Duchess of Burgundy.

Countess. Since this Thread is so common, why have they not erected it into a Manufacture?

Prior. This was one of the Attempts of Monsieur *Reaumur*, who is generally striking into new Projects, that are very happy and important, even on the most common and neglected Subjects. This Gentleman endeavoured to collect a large Number of these Insects, and caused them to be fed with Flies, and the Ends of young Feathers newly plucked from Chickens and Pidgeons, because such Feathers are full of Blood, and easy to be got, and besides this, they are delicious Regale for the Spiders. But he was soon convinced that all his Care to nourish them with their most palatable Food, was ineffectual; for there is such a Malignity in their Dispositions, when a Number of them are together, that they sacrifice all other Attentions to their natural Animosities, and are perpetually endeavouring to devour one another. You see then, these are a People incapable of being established into a Community; and tho it were practicable to unite them in a Manufacture, it would require too much

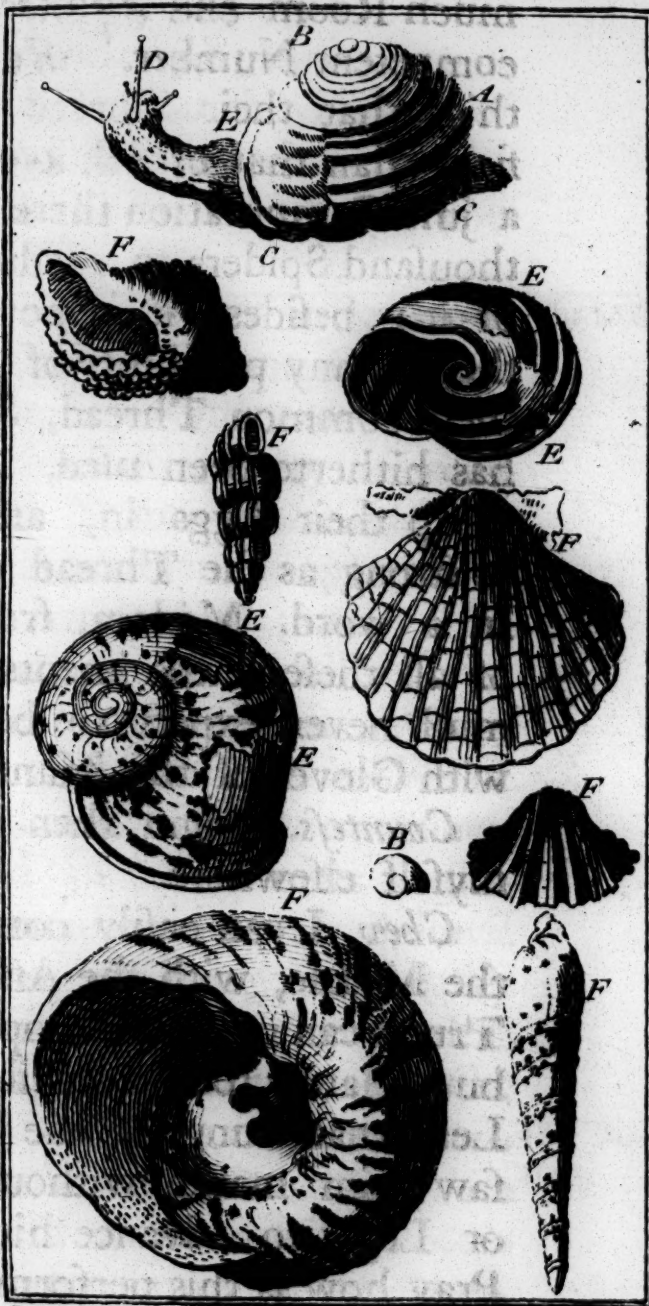
much Room and Application to rear a competent Number. We may add to this, that their Thread is five times finer than that of a Silk-Worm, and by a just Computation there must be sixty thousand Spiders to produce one Pound of it; besides, it is not certain that there is any possibility of manufacturing their common Thread, for that which has hitherto been used, is what they wrap their Eggs in, and four times as strong as the Thread of their Web. In a word, Madam, from the Result of all these Experiments, I doubt you must never expect to be well stocked with Gloves of this Manufacture.

Countess. I find then I must supply myself elsewhere.

Chev. I can easily comprehend how the Muscle, with the Assistance of her Trunk can move and stop as she pleases; but I lately took a Snail from a Vine-Leaf that hung at the Window, and saw him march without any Trunk, or Legs, to advance him in his Way. Pray how is this performed?

Countess. I am likewise in pain, to know how the Snail, the Muscle, and all sorts of Shell-Fish, build the House they always carry about them, and in what manner they retire when one touches them never so tenderly.

Prior



Part I. p. 254. F

A. Motté sculp.

Prior. I have sometimes examined the Structure of a Snail with much Attention, and can give you the History of all that belongs to him, except the Formation of the Shell, which I reserve for the *Count*.

Here we are no longer entertained ^{The Snail.} with Plumes, nor Hair, nor Cones of Silk. This is a new Order of Being, wherein the Intentions are very different. Every Animal in Nature has an Habitation, and each Apartment its particular Beauties and Accommodations. The Roof under which the Snail resides, comprehends two Advantages, which, one would imagine, were incapable of being united, I mean, an extraordinary Solidity and an uncommon Lightness. By means of which the Animal is protected from all Injury, and easily transfers her House where she pleases; and in what Country soever she travels, is always at home. At the Approach ^{Her Retreat.} of the Cold*, she retires into some Cavity, and her Body distils a certain Glew that condenses at the Aperture of the Shell, and intirely closes it up. When she is thus shrouded, she passes the disagreeable Season like a number of other Creatures, free from

* Memoirs de l'Academ. des Scienc. 1709.

all Pain and Want. When the Spring paints the Earth with a Bloom of Flowers, the Snail opens her Door, and seeks her Fortune ; at which time all her Necessities revive with her Appetite ; but in her creeping Progress, and charged as she is with the Weight of her Apartment, if her Eyes were sunk as low as the Body she trails along the Ground, she could not perceive the Objects she ought either to avoid or approach, and besides this, would be perpetually liable to plunge and soil her Eyes in the Dirt ; to prevent which Inconvenience, Nature has supplied her with four Telescopes, to assist her in the Discovery of all Objects that surround her.

Chev. Have you ever seen, Sir, the Tubes of these Telescopes?

Prior. I assure you, Sir, I am not in Jest. I only acquaint you with the simple Fact. Don't fancy then, that those Projections which Children call the Snail's Horns, are really such. They are four Tubes *, with a Glass fixed in the Extremity of each ; or they may be called four optick Nerves, ending in as many beautiful Eyes ; and the Animal not only raises its Head to take a distant

* Lister. Exercit. Anatom. Cochli.

View, but also extends these four Nerves, and the Eyes in which they terminate, much higher. She directs them where she pleases, so that they are real Telescopes which she lengthens, turns, and contracts, as she finds it necessary.

Thus you have seen her lodged and illuminated. She is qualified to discover whatever may be commodious to her; but as she is destitute of Feet, how shall she march to obtain what she wants? This Defect is supplied † by two large muscular Skins, that are lengthen'd by letting them out; after which, the fore-part of these Skins is shorten'd into Folds, and that in the Rear falls into the same Contraction; and by this means they draw the Mansion that rests upon their Surface. But here another Difficulty arises: As she is constantly clev'd to the Earth, and has neither Wings to raise her into the Air, nor Hands to sustain her from falling, she must be expos'd to the Danger either of tumbling from some Precipice, or being crown'd in the first Water wherein 'tis her Misfortune to plunge; and the very Humidity alone would penetrate and

Her Motion.

† Derham, Theol. Phys. l. ix. c. 1. Lift, *ibid.*

Her
Glew.

destroy her. But here Nature has interposed, and delivered her from all these Inconveniences, by replenishing her with a viscous Humour that by its Cohesion preserves her from falling, and renders her impenetrable to all Moisture by the Ministration of an Oil, with which she closes all the Pores of her Skin. This precious Oil she manages with great Frugality; she avoids the Sun that would evaporate it, and easily preserves it in moist Places, where it proves extremely beneficial to her.

Her
Teeth.

Nothing hinders her, at present, from searching out her Food*; and when she has found it, she cuts and divides it with two sharp Teeth, with which she sometimes makes great Devastations on the finest Fruits, the tender Buds of Plants, and even the Leaves themselves on whose Preservation that of the Fruit likewise depends. You see therefore that Nature has not neglected this Animal as contemptible as she may appear to us but has even furnished her with many peculiar Advantages.

The Generation of
Snails.

But the most surprizing Circumstance that attends these Creatures is this

* Godart. Insect. Tom. i. Lister de Cochli. Hoo
Micrograph. Obs. 40.

they are all Hermaphrodites †, and have the two Sexes united in them ; so that each of them gives the same Fecundity to another that at the same time is communicated to itself. When they are disposed to approach each other ‡, they signify their mutual Inclinations in a manner peculiar to themselves ; one launches against the other a kind of little Dart, that has four Wings or minute Edges. This Weapon flies from the Animal that shot it, and either lodges in the other or falls down by him, after making a slight Wound ; upon which this Creature, in his Turn, dispatches another Dart at the Aggressor ; but this little Combat is immediately succeeded by a Reconciliation. The Substance of the Dart is like Horn. And the Animals are stocked with them at the Seasons when these Approaches are made, and which happen each Year thrice in every six Weeks, that is to say, once every fifteen Days : And each Insect, eighteen Days after every one of these Periods, deposits its Eggs in the Earth, and there hatches them with extraordinary Care. My great Curiosity at pre-

† Historie de l'Academie des Scienc. 1708. p. 48.

‡ Lister de Cochl.

sent would be to know, if the Shell of the Sail is hatched in the Egg itself, and how it is augmented and repaired on every necessary Occasion.

Count. I can satisfy you, Sir; for I have made five or six Experiments that have succeeded perfectly well, and enabled me to answer all your Questions.

The Shell.

When the Snail leaves the Egg she is array'd with a Shell completely form'd*, and of a Minuteness proportionable to her Body, and the Dimensions of the Egg that inclosed it. This Shell proves the Basis of a second, that is perpetually increasing; and the little Shell, such as it is, at its Eruption from the Egg, will always be the Center of the other, which the Animal, advanced in her Growth, forms and completes by adding new Circles to the first Shell: And as her Body can only be extended towards the Aperture, this must consequently be the Part that receives the fresh Accessions, the Materials of which are lodged in the Body of the Animal, and formed by a Liquor, or viscous

* Malpighi Anatom. Plan. de Coch. Memoirs de l'Academ. des Scienc. 1709. Monsieur de Reaumur Leeuwenhoek's Arcan. Nat. Tom. iii. Ep. 2.

Fluid composed of Grew, and several sandy Particles of an exceeding Fineness. These Ingredients are transmitted, thro' a great Number of little Tubes, to the Pores, with which the whole Surface of the Body is perforated; but these being all closed by the Shell that covers them, the mixed Fluid is projected thro' other Channels, to those Parts of the Body that advance out of the Shell, and are intirely destitute of any Covering; and now the Particles of Sand and Grew transpire without Impediment, and thicken into a Consistence round the Extremity of the Shell. This viscous Matter is drawn out into a thin Film, under which a second is soon after extended, and this proves a Covering to a third. From the Union of these three Films results an Incrustation of the same Quality with the rest of the Shell. When the Animal increases in Bulk, and the Extremity of the Shell is not sufficiently covered, she continues to evacuate and build in the same manner: And thus it is that she erects and repairs her Habitation. Some time ago I took several Snails, and broke off part of their Shells without bruising the Animals. When this was done, I placed them under a Set of Glasses, and took care to accommodate them with a proper

per Quantity of Earth and green Leaves; and then I immediately took notice that the same part of the Body which became visible by the Fracture of the Shell, was covered with a kind of Froth, or Sweat, that flowed thro' all the Pores; after which I saw this Froth gradually propelled by a second Evacuation, that in a little time raised the Surface of the former to a Level with the old Shell.

Prior. But is your Lordship sure that this forming Juice flows from the Body of the Animal, and not from the adjoining Shell?

Count. I have as much Certainty as the Fact will admit, and this is the Method I took for my Satisfaction. When I had made the Fracture in the Shell, I took the little Skin that grows under the Shell of a Hen's Egg, and carefully slipped it in between the Body of the Snail and the Extremity of the Fracture: and if the Shell had then contributed to its own Reparation, the Juice that would have flowed from it must certainly have been shed over the little Skin, and had covered it in proportion as the Cavity closed. As, on the contrary, if the Fluid proceeded from the Body of the Snail, this Skin would have prevented its Effu-
fio

sion to the Shell; and in this Case the Juice would settle between the Cuticle and the Body of the Animal, which, in reality, happened to be the Fact.

Prior. I have no Objection to this Experiment.

Count. I had another Method of satisfying my Curiosity, which was this: I broke off all the last of those four or five Contours into which the Shell of a Snail winds; after which I drew, between the Shell and the Body, a Slip of a Glove made of the finest Skin, which I afterwards reversed, and glewed on the exterior Verge of the Shell. Now, if the forming Fluid had distilled from this, it would have forced away the little Skin, instead of which it was not once moved; but then the third part of the Snail and more, that remained exposed to the Air, was immediately covered with a Sweat that harden'd into a new Contour of Shell, and wound over the former in such manner, that the little Skin of the Glove lay between them thro' the whole Progress of the Contortion.

Prior. I am very glad to see this Point cleared up, because the same Facts that explicate the Formation of a Snail's

Shell illustrate also that of all sorts of River and Sea Shell-Fish. Let me beg your Permission then to propose another Difficulty, for I am persuaded it will furnish us with new Discoveries. If the Shells then are formed as the *Count* has been describing, and the Fractures they receive are repaired by a Matter that passes thro' the very same Perforations that originally ejected the Substance of the shatter'd Covering, the new Piece that fills the Vacancy should exactly tally in Colour with the old Fragment, as well as with all the rest of the Shell, and yet I have seen several Snails repair their Shells in such a manner that the additional Piece was of a different Colour from all the rest.

'The Spots
in the
Shell.

Count. Your Observation does not destroy any thing I have advanced, and you now give me an Opportunity of explaining the Original of those Streaks and Clouds we observe with Admiration on the Shells of Snails, and the generality of Shell-Fish.

Chev. I should be glad to know the Cause; for I have frequently viewed some Shells where the Streaks were exactly drawn from the little Point in the Middle to the very Edges of the Aperture, and others, where these Streaks were

were discontinued, or mingled with little Stains that had no ill Resemblance to our Notes in Musick. What can occasion this Diversity?

Count. It proceeds from the different Disposition of the extreme Parts of the Animal's Body, that are visible at the Aperture of the Shell, where one may frequently discover some minute Lobes or Lines of Flesh that differ from the rest in Colour. This Variety demonstrates that they have a different Texture from those that are contiguous, and consequently the Juices that flow into them, passing thro' strainers, whose Perforations vary from those of the adjoining Parts, acquire a particular Complexion; and as these Lobes perform their Functions and Evacuations as well as the others, and, in the successive Formation and Enlargement of the Shell, contribute their Proportion with the rest of the fleshy Substance that is, from time to time, thrust out, all the Points of the Shell that correspond with them, must inevitably assume the same Colour, and which differs from that of the contiguous Lobes: and consequently these Colours must be drawn out and distributed into Lines and Rays, and continued as long as the Animal

Animal persists in her gentle Motions, and makes new Additions to her Shell by the repeated Protrusions of her Body:

But that you may the better comprehend this Work, it is necessary for you to know, that as the Animal increases in Growth, she draws her Tail from the Bottom of the Shell, that now becomes too little for its Reception. She then ascends higher, and fixes her Tail near the second or third Contortion of her Shell, and enlarges her Apartment at the Opening. As she makes these Advances by little and little, and moves from Point to Point, as they lie contiguous to each other; those Parts of her Body in the Aperture of the Shell, that by the Diversity of their Pores cause this Variation of Colours in the Shell, form one continued and regular Streak; but when the Animal, in changing her Situation, leaves an Interval between the Point from whence she removes her Tail, and the new one to which she fastens it, all the other Parts of her Body move in the same proportion, and those in the Orifice of the Shell that impress the Stains, being transfer'd to some Distance from the preceding Stain, tinge the Shell so as to leave a Space

more

more or less Extent between each Spot, and this is the Origin of your musical Notes. Different Causes may concur to paint and vein the Outside with Colours more or less lively in their Glow. The Quality of the Food, the Health or Indisposition of the Animal, the Inequality of her Temperament, according to the several Periods of her Age, and the Changes that may happen to the different Perforations of her Skin : In short, a thousand Accidents may intervene to heighten or diminish certain Tints, and diversify the whole to Infinity.

If the Shell, in the Variety of its Colours, imitates the Diversity of the Animal's Pores, it is still more apparent, that it must assume the Form of the Body on which it is moulded. Thus we see in all Sea Shells, that if the Animal has any Swelling or Inequality on its Body, a Tumour likewise rises in the corresponding Part of the Incrustation. When the Creature displaces herself, and enlarges the Dimensions of her Dwelling, the same Tumour that had already raised the Shell in one part, swells a-new at a little distance, by which means you see the same Species of Inequality in a winding Line round the Shell. Sometimes these Protuberances

The Tumours and Inequalities of the Shells.

of

of the Animal are so large, or so pointed, that those which rise over them in the Shell are like Horns. She disengages herself from these first Cavities, and by new Evacuations of Sweat strikes out another Set of Horns, that protect her from Fishes that are fond of her Flesh. If her Body happens to be channel'd, the Shell that covers it has the same Configuration: If the Flesh rises in Swellings that wind round her in the Form of a Screw, the Shell has likewise its Elevations and Depressions, that ascend in a spiral Line from her Tail to the Extremity of her Body.

Prior. His Lordship's Exactness in this Account of the Formation of Shells is confirmed by what we ourselves frequently see. Nothing is more common than to find in the Aperture of a Snail's Shell, and along the Rims of the two Shells of a Muscle, a little Film, which is only the Sketch or first Plan of the Addition the Animal intends to make to her Habitation. Besides this, when you throw the Shells of Muscles, Snails, or Oysters, into the Fire, the Heat shivers them into thin Plates, or rather separates the different Strata of Matter that compose the Shell, and makes them visible.

ble when it dries and bursts with Vehemence from between them.

Chev. Since we are upon Shells and Oysters, I hope his Lordship will be so good as to inform me, from whence could proceed the two little Pearls we found in one of the Oysters that were brought to Table Yesterday.

Count. My Thoughts upon the Matter, Sir, come to no more than this; the Oyster was afflicted with the Gravel*.

Chev. Is your Lordship serious?

Count. Perfectly so.

Chev. How! are these Pearls which we so much admire, and purchase at such an Expence, the Effect of a Disorder in the Animal that produces them?

Count. If the Fact be not very certain, is at least extremely probable. The Juice or Glew with which Oysters and large Sea Muscles form, by Transpiration, the first Structure and future Enlargements of their Shells, is sometimes extravasated and forced out of its natural Repository. It is then amassed in drops, and harden'd into little Balls or

* Memoirs de l'Academ. des Scienc. 1717. Monsieur Reaumur. Actes de Leipf. 1686. Bonanni.

Globules, which are the very Pearls you inquire after.

Prior. It is certain that the Pearl and Shell are exactly of the same Colour, which makes it probable that they are both composed of the same Materials. In a Journey which I took twelve Years ago, to the Southern Parts of *France*, I had an Opportunity of seeing the two Ports of *Marseilles* and *Toulon*; and in the last of these they shewed me some large Sea Muscles, whose Shell was above two Feet long. Upon opening them we found several Pearls, some red and others coloured like Mother of Pearl; but the red Pearls were in that part of the Animal where the Lobes of her Flesh tinged her Shell with a red Dye, and the Pearls of the Colour of Mother of Pearl, were lodged in that Part where the Shell was tinged with the same Hue, which shews the perfect Conformity there is between the Juice which forms the Shell, and that which constitutes the Pearls.

The Shell
and Eyes
of Crabs.

But let us take notice of all that can be advanced against this System. Crabs divest themselves of their Shell every Year, and eject a Liquor that glides over their whole Body, and which by degrees growing dry and hard

ard, changes to a Shell as strong as
that they cast off. At the Approach of
his Moulting-time, if I may so call it,
one finds in the Body of this Creature
certain Stones, which are improperly
called its Eyes. These Stones decrease
in Size, in proportion as the Shell con-
solidates, and are not to be found in
the Creature after the Shell is com-
pleted; which Observation made a ce-
lebrated Member of the Academy af-
firm, that these Stones were the Ma-
gazine or Stock of Matter which the
Crabs employ'd in the Renovation of
their Shells. May not the Case be
the same with the Oyster and its Pearl,
as it is with the Crab and its Eyes;
and may not these Pearls be a Reserve
of Matter appropriated to repair the
Shells in the time of need?

Count. Your Comparison seems at
first a little embarrassing, but upon a
nearer View it favours my Purpose.
Whatever constitutes the essential Part
of an Animal, is to be found in each
individual of the Species, and it is
not probable that Nature should on-
ly in some Instances accord that to
them which they cannot by any means
subsist without. On the contrary, that
which is a Default in an Animal, is
only

only found in some of the Species; for no Default can be universal. The Stones in Crabs that seem necessary Materials for the Reparation of their Shell, are to be found in the whole Species of these Creatures, at the Time when they change their Covering. But there are vast Quantities of Oysters in which Pearls are never discovered; from whence we may infer, that the Pearls are a Default in the Oister, and a Default too not very common. If the Pearls were the Stock of Materials with which the Oisters renewed or repaired their Shells, every one of these Animals would have its particular Magazine.

Gemelli.

Besides, it has been observed by Travellers, that the Coasts where the Pearl Fishery is carried on, are unhealthy; which makes it very credible that the Oisters caught there owe their Pearl to some Indisposition that affects them. The *Spaniards* have abandoned the Pearl Fishery in *America*. It is certain, that the Air and Water of the Isle of *Babaren* *, from the Banks and Rocks of which the Divers bring up Oisters, are insupportable to those that

* In the *Persian* Gulph.

trade there for Pearls ; nay the very Peasants have such an ill Opinion of the Oysters that produce them, that they never eat any. On the contrary, the more delicate our Oysters are, the fewer Pearls are found in them ; from whence it is natural to conclude, that the Waters which afford the greatest Quantities of these pearly Fish, are unwholesome ; whereas the Oysters that either live in a more salubrious Fluid, or are nourished with proper Juices, produce few or no Pearls, because their Temperament is free from all Sickness and Disorder.

Prior. I submit : Your Account appears to me very satisfactory.

Count. Tho the *Chevalier* is not acquainted with Shells, yet, if he will step into my Closet, he shall see such a Collection as will entertain him extremely with the Richness and Variety of their Colours. He will see, in that little Space, some of the Curiosities of the four Quarters of the World. Some Persons distribute them into different Classes, and call each Shell by the Name of what it most resembles. There is no extraordinary Merit in the Ability of

T giving

giving each Class its Denomination; but it has its use, because you, by this means, avoid Confusion, and can methodize this Part of Natural History. One is infinitely affected at the Sight of this prodigious Variety of Species that are constantly propagated with the completest Similitude thro' every Age: They are all formed upon the same Design, which is, to protect the Animal from Injury. But what a surprizing Variety flows from the Execution of this single Design? They are all invested with Perfection, Graces, and Advantages accommodated to their Nature: Industry and inexhaustible Sources are conspicuous thro' every Tribe. Some curious Persons who are not so studious of the Natural History of those Shells, as they are of the different Effects they are capable of producing, by the Assemblage and Disposition of their amiable Colours, make large Collections of them in all Shapes, and work them into artificial Rarities of a peculiar Taste; such as Sprigs of Flowers, Garlands, Grotto's, Landskips, Architecture, and Figures of Men and Animals.

Animals, the whole composed of large and little Shells. This sort of Work requires much Patience, and sometimes a great Share of Genius and Ingenuity. My Desire, in shewing you my Collection, is to give you a better Idea of what I have told you about the manner of their Formation.

Chev. I shall be exceedingly pleased to repeat your Observations, and compare them with the Shells themselves; but I forget to let you see three or four that I have carried in my Pocket a considerable time; they are very pretty in their kind, and here they are.

Count. These are all petrified.

Chev. Petrified? Pray what may your Lordship mean by that?

Count. My Meaning is, that the Shell, as well as the inclosed Oyster, lying in some Fluid of a petrifying Quality, have assumed the Nature of Stones without changing their own Figure.

Chev. I cannot comprehend what you are speaking of; for Oysters are taken in the Sea, but I found this on a Mountain. Some

short time before my Father went to *Amiens*, he covered his Parterres and Walks with Sand. Adjoining to his Estate are two Hills, where his Servants went to get two different sorts of Sand, and each of a most agreeable Colour; the one Grey, and the other Yellow tending to Red. Every time I went to see the Workmen that were employ'd in digging the Sand, they gave me some of these Shells, which they often found in little Heaps, and they must certainly be of a different kind from those that are found in the Sea.

Prior. Very well, Gentlemen, I find you are agreed in the same Design. Farewel Insects, and Shells; you are going to examine the History of the Earth, as it was before the Deluge. You see the Subject is pretty extensive, and I must take my Leave.

Count. No, Sir: I beg the Favour of your Company for a Moment. We shall want your Assistance; and a short Digression on the *Chevalier* Question will be more instructive to him than Pearls of the brightest Water. My dear *Chevalier*, I will shew you immediately, in my Collection
thre

three Shells that are precisely the same as yours, and both the one and the other have floated in the Waves of the Sea.

Chev. Who then has been at the Pains to carry them into the Heart of a Mountain?

Count. The Sea itself.

Chev. But I have heard that the Sea never passed beyond certain Limits; and tho by the Effect of some Tempest, or other Accident, it should happen to overflow the neighbouring Plains, it can never extend itself to the Distance of twenty Leagues and more, for our Estate lies as far as that from the Sea.

Count. How, *Chevalier*! Can't you guess when this Event happened? Would not the Difficulty you are under increase upon you, should I tell you, that in the very Middle of *Africa** there are Plains full of Shells above three hundred Leagues from the Sea, and that Heaps of them are piled up on the Top of the Alps themselves? You now find the Sea

* Hist. & Memoirs de l'Academ. des Scienc. presque chaque année.

flowing

flowing over the Mountains. How shall we solve this Inundation?

Chev. On the contrary: I find the Difficulty begin to lessen. The Mass of Shells must certainly be convey'd to these Places by the Waters, when they deluged the whole Earth, and swelled fifteen Feet above the highest Mountains. Give me my Shells again, if your Lordship pleases, for they are Curiosities older than the Flood.

Prior. It is certain that all Nations have retained a Remembrance of the Deluge, and even the Poets have not lost the View of it amidst the Obscurity of their Fictions. The whole Earth is covered with indelible Monuments that attest the Progress of the Waters; and the universal Deluge is an Event whose Proofs are still presented to our Observation, in what manner soever it was occasioned, and as incomprehensible as it may appear. From whence results an important Truth; and let me intimate you, *Chevalier*, to fix it in your Memory; it is this, there are, both in Nature and the sacred Writings, Things above the Reach of Man's Con-

Of INSECTS.

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Conception ; but the Reality of whose Existence does not, for all this, cease to be certain, and capable of Demonstration.

The End of the FIRST PART.



272

OF INSTEAD

Conspicuous in the history of which
England does not for a long time
in her career and capital of the
nation.

4 AP 64



Part the Second.

BIRDS.



DIALOGUE X.

The Count and Countess de JONVAL.

The PRIOR.

The Chevalier du BREUIL.

Countess.



YOU seem to be at
a Loss, Gentlemen,
for a new Subject of
Conversation. Let

us proceed to Birds. Will you be al-
ways creeping on the Earth with your
Snails and Reptiles?

B

Prior.

Prior. Let us take our Flight from terrestrial Dross, and grow acquainted with the Inhabitants of the Air. All the Universe, you see, is replenished with Life : Every Part of Nature abounds with Action and its proper Animals : You cannot proceed one Step without discovering new Traces of a Wisdom, as inexhaustible in the Variety of its Plans, as in the Richness and Fertility of the Execution. Cast your Eyes on that Bird who wings the Air ; nothing is more natural to Eyes that have been habituated to such a Sight, and nothing is so astonishing to the Opticks of Reason. It is evident that a passage through the Air which has been denied to other Animals is open to these. A Bird in Flight is a Mass raised aloft in Spite of the Weight of the Air and the powerful Gravitation impressed on all Bodies, and which impels them to the Earth. This Mass is transported, not by any foreign Force, but, by a Movement accommodated to the Purpose of the Bird, and which sustains her a long Time with a graceful Vigour. This is another Subject of Admiration. I consider all these Birds, I see each Individual furnished with no more than two Wings, and yet I observe them all flying in a different Manner : Some launch away
in

Of B I R D S.

3

in repeated Springs, and advance by successive Boundings ; others seem to glide through the Air, or cleave it with an equal and uniform Progress. These always skim over the Earth ; those are capable of soaring up to the Clouds. You will see some who know how to diversify their Flight, to ascend in a right, oblique, or circular Line, to suspend themselves and continue motionless in an Element lighter than themselves ; after this, to start into an horizontal Motion, and then dart themselves either to the Right or Left, wheel into a contrary Track, remount, and then precipitate themselves in an Instant like a descending Stone ; in a Word, they transport themselves without Opposition or Hazard where-ever their Necessities or Pleasures invite them. When I am conversant with them in their Habitations, I still find them equally surprising. I am enchanted with the Structure of their Nests, the Sollicitude with which they attend their Eggs, the Mechanism of the Egg itself, and the Birth and Education of their Young.

Countess. The Prior, in his Enthusiasm, has given us an agreeable Disposition of the Particulars of our Entertainment. I charge myself with the Nest and domestic Employment of the

B 2

Bird,

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B 2

Bird,

Bird, for I would willingly have my Part as well as the rest. Do you know where I pursued my Studies? Truly, with my Finches, my Pigeons and Ducks; I know them all by Heart.

Count. Indeed, Madam, they are the best Books; and the Portraits you copy from Nature, will always have the finest Likeness.

Chevalier. Her Ladyship has had an Opportunity of observing several particular Curiosities in that delightful Bower which the Count has intirely latticed with Brass Wire. I think I have seen in this charming Aviary all imaginable Sorts of little Birds, as well as those of a midling Size.

Countess. Chevalier, this Aviary boasts a little of my Invention, and I commonly undertake the Management of it, but my Pains are requited by Pleasures that vary every Day. The Contentions of these little Creatures, their Endearments, their Melody and Labours, and the obliging Civilities I receive from the Generality when I pay them a Visit, are extremely entertaining to me. I carry my Work to them, and am never alone. One may pass whole Hours and Afternoons there, without finding the Conversation languish, and it seems to me to be that
Part

Part of the House for which the Chevalier has the greatest Fondness.

Chevalier. I am surprized we don't every where meet with such an easy Amusement. But what prevents us, Madam, from adjourning the Assembly to the Aviary? We can't talk of Birds in a more proper Situation; we shall have a full view of them all when they come by Turns to play and drink on the Edges of the little Canal that runs through the Bower.

Countess. I have lately seen a Couple of new Broods,* though the Season be far advanced. The Affair is of some Importance, because they are two Species I am very desirous of preserving. Long Visits and abundance of Company discompose them, and make them frequently forsake their Eggs; but without invading the Liberty of our Solitaires, I will acquaint you with the Structure of their Nests, as well as if they were before your Eyes.

I am never tired with observing the ^{The Nest.} perfect Similitude that appears in all the Nests of Birds of the same Species, the Difference between the Nest of one Species and that of another, and the

* The Goldfinch, Greenfinch and others, sometimes build their Nest in *August* and *September*. These Exceptions, which are very rare, don't destroy the general Order remarked in Page 46.

Industry, Neatness and Precautions that reign through the Whole. As my little Prisoners cannot make Excursions for the necessary Materials to build their Nests with, I take care to supply them with every Thing I imagine can be agreeable to them, and am curious to observe what composes those Nests the Children bring me from all Parts; accordingly I throw into the Aviary, Sprigs of dry Wood, Shivers of Bark and dry Leaves, Hay, Straw, Moss, Down, Wooll, Silk, Spiders Webs, Feathers, and a Hundred other little Materials that are all useful in the Nest. You would smile to see the Inhabitants come to traffick at this Fair: One wants a Bit of Moss; another has Occasion for a Feather; a third can't do without a Straw; you will see two out bidding one another for a Lock of Wooll, and this sometimes causes great Quarrels; however the Difference is commonly adjusted, and each carries what she can to the Nest.

They are as well furnished with Provisions too; and I have appointed a Steward or Purveyor for them, who waits on them with Worms, Caterpillars, Flies, besides several Sorts of Grain, and who serves them all according to their Appetites in each Season. One finds a great

great Advantage in bringing them up in this Manner under a green Covering. They enjoy a better State of Health, act with more Freedom, and one has a better View of their various Characters and Labours.

One Species builds its Nest on the Top of Trees. Another chuses to settle on the Ground under a Canopy of Grass, but where-ever they dispose themselves, they are always accommodated with a Shelter, and either make choice of Herbs, or a shady Branch, or a double Roof of Leaves, down the Slope of which the Rain trickles, without entering into the little opening of the Nest that lies conceal'd below. The Nest is rais'd on more solid Materials that strengthen it with a Foundation; for which Purpose they make use of Thorns, Reeds, thick Hay and compact Moss. On this first Lay, that seems very shapeless, they spread and fold in a Round all the most delicate Materials, which being closely interwoven, prevent the Access of Winds and Insects. But each Species has a particular Taste in the Building and Furniture of its Apartment, and when this is compleated, they never fail either to hang the Inside with a Tapestry of Feathers, or quilt it with Wooll or Silk itself, in

order to communicate a convenient Warmth around them and their Young. When their Supplies fail them, there is scarce any Invention to which they have not Recourse for a Recruit; and this is what I learnt from the first Thistle-Finches I bred: I only furnished them with Hay for the Structure of their Nest, and the Female, for want of Raw Silk or Cotton, found out an Expedient that surprized me. She began to unplume the Stomach of the Male without the least Opposition from him, and afterwards hung all the Apartment very artificially with the Down.

Chevalier. This indeed is astonishing. Who acquainted this Mother that she would have Eggs and Young, and that these Eggs could not be cherished without Heat?

Prior. Admire the Skill and Industry, as well as the provident Care of this Creature; or if you will not allow her to be Mistress of these Qualities, acknowledge their amiable Display in Him who furnished Man with the Gift of Reason that extends to every thing around him; and who inspired Animals with an Imitation of this Reason, limited indeed to a single Point, but admirable in that very Limitation. For is it not an infinite Reason that directs the Labour

Labour of this Bird when she builds her Nest? Who informed her that she should lay Eggs and that she would want a Nest to preserve them from falling, and cherish them with a genial Heat? that this Heat would not be concentrated round the Eggs were the Nest too large, and that the Nest would be incapable of containing all the Young were she to give it less Dimensions? How comes she to know its just Proportion and Extent, with the Number of Young that are to be born? Who has regulated her Almanack that she might not mistake the Time, and to prevent her from laying her Eggs antecedent to the Structure of the Nest?

Count. There is one Circumstance that astonishes me yet more. The Workman who makes a Basket, is furnished with Fingers and Impliments. The Mason has his Hod, his Trowel, his Line and Square. But the Inhabitants of my Aviary, who accomplish Works of every Kind, have no other Utensil but their Bill.

Countess. Forgive me an odd Thought that comes into my Head. Let us suppose *Dedalus*, or what other Architect you please, to be transformed into a Bird, no longer accommodated with Arms, or
Tools,

The Nest
of a Tit-
mouse.

Tools, or Materials, and Master of nothing but his Science and Beak. How will he employ them? The Bird indeed has a Beak, but no Science, and yet she forms Works that discover all the Propriety of the Basket-Maker, and all the Industry of the Mason; for in some of these Nests, the Hairs and Reeds are interwoven with great Dexterity: * Others have all their Parts properly fastened and connected with a Thread which the Birds spin from a Flew, as well as from Hemp and Hair, and, generally from the Webs of Spiders, which she easily procures when these wandering Creatures dart from Place to Place and fill the Fields with their Threads, by the Assistance of which they change their Situation and go in quest of Company. † There are other Birds, such as the Black-Bird and Lapwing, who, after they have made their Nest, rough-cast the Inside with a small Lay of Morter, that glews and binds all below; and by the Aid of a little Flew or Moss, with which they temper it when it is fresh and soft, form a compleat Wall within; let us rather call it an Apartment commodiously furnish-

* Derham, Theol. Phys. l. viii. c. 4. rem. 5. Raii. Synops. Avium p. 74. † Willughby's Ornithol. p. 140.

ed, and properly calculated to preserve the necessary Warmth. I have frequently, from my Window, seen the Swallow either beginning or repairing her Nest, which is a Structure intirely different from all others: She wants neither Wood, nor Hay, nor Bands, but knows how to make a kind of Plaister, or rather Cement, with which she erects a Dwelling equally secure and convenient for herself and all her Family. She has no Vessels to receive the Water she uses, nor a Barrow to convey her Sand, nor a Shovel to mix her Morter; but I have seen her pass and repass over the Basin in the Parterre; she raises her Wings and wets her Breast on the Surface of the Water, after which she sheds the Dew over the Dust, and then tempers and works it up with her Bill. But I try your Patience, Chevalier, I am a little extravagant in my Fondness for Birds.

The Swallow's Nest.

Chevalier. Let me intreat you, Madam, to continue your Account, for I am charmed with hearing you. And, Pray what succeeds when the Nest is compleated?

Countess. The Dam then lays her Eggs, the Number of which varies according to the Species: Some have only two at a Time, others, four or five, and

The Brood.

and some seventeen or eighteen. When the Eggs are laid, the Male and Female brood over them by Turns; but this is generally the Females Province. And here we must unavoidably admire the Impressions of a superior Reason that act upon these Creatures: They have no certain Knowledge either of what their Eggs contain, or of the Necessity there is to sit on them in order to hatch them, and yet this Animal who is so active and unsettled at other Times, in this Moment forgets her natural Disposition, and fixes herself on the Eggs as long as is convenient; she submits to Restraint, renounces all Pleasure, and continues almost Twenty Days, inseparable from her Brood; and that with a Tenderness so extraordinary as makes her forget to eat. The Male on his Part shares and alleviates her Fatigue, he brings Food to his faithful Mate, repeats his Journeys without Intermision, and waits on her with the Collation ready prepared, in his Bill; his Services are accompanied with the politest Behaviour, and if he ever discontinues his Affiduity, 'tis to entertain her with his warbling: He acts with so much Fire and Alacrity, and puts on so many Graces in the Departures and Returns he makes to serve her, that one is at a loss

loss to know whether the painful Perseverance of the little Mother, or the officious Inquietude of her Spouse, are most to be admired.

Perhaps the Chevalier will not be displeased at my acquainting him with the Cares they undergo in the Education of their Young, but it would not be improper, before this, to give him a Description of what the Egg contains, as well as of the Manner in which the Young is there formed, and how it afterwards issues from its Confinement. An Egg is a very common Food; but, dressed in a particular Manner, it may prove an agreeable Regale. Can you, learned Gentlemen, tell us what an Egg is?

Count. We will serve it up to you, Chevalier, in the best Manner we possibly can.

It would be easy for me to fatigue you with too much anatomical Exactness. Let us content ourselves with an unpolished, but true Description. * One may judge of the Eggs of the smallest Birds, by that of a Hen, where the Parts are more apparent. † We may easily distinguish the Yolk that is in the Heart of it, as likewise the first white Sub-

* Malpighi de ovo incubato. Ornithol. l. i. c. 3.

† Willughby's

stance that furrounds it ; and a second White in which the Mass in the Middle swims ; besides these, we can see the Ligaments that sustain the Yolk towards the Center of the Egg, together with the Membranes that enfold it, one yellow, another black, and a third and fourth that encompass the whole ; and lastly, the Shell that defends all the rest. What lies within these Inclosures has the first Formation, the Shell makes the last Appearance and hardens from Day to Day : 'Tis a Fluxion of Salts evacuated from the Humours of the Dam, and which the Heat fixes and consolidates round the Egg to form a Crust that has a double Function ; one is to put the Mother into a Condition of discharging the Egg without crushing it, the second is to preserve the Young from all Accidents till it be formed, and in a Capacity to forsake the Egg. * We may even say that the Egg performs to young Birds the Office of a Breast and Milk with which the Offspring of other Animals are nourished, because the little Chick that lies in the Egg in the State of a Nymph, and concealed under the Skin of a Worm, is first sustained with the White of the Egg, and af-

The
Chick.

* Leeuwenhoek, Ep. phys. 40. Willughby. *ibid.*

terwards

terwards with the Yolk, when the Animal has gathered a little Strength, and its Parts begin to be fixed. Under this Membrane that surrounds the Yolk, is found a little Cicatrice or white Spot, ^{The Cicatrice.} which is only the Seed where the Worm resides. The Egg, into which this little Animal is injected, becomes prolifick, but that wherein no such Creature can be discovered, wants the Seed, and contains only a barren Nutriment. The Females sometimes lay Eggs without any Congress with the Male, but they never produce any thing. The little Chick, under the Form of a Worm, is continually situated on the Yolk, and always ascends to the Top of that Side where the Warmth of the Dam attracts her. But as it would quickly be overthrown, were the Egg removed, and in such Case would no longer be sensible of the Heat that is so necessary to its Welfare; the Yolk is poised by two Ligaments which are al- ^{The Ligaments.} ways visible at the Aperture of the Egg, and fasten it on each Side to the common Membrane that is glewed to the Shell; should one draw a Line from one Ligament to the other, it would not exactly pass through the Middle of the Yolk, but above the Center, and would cut the Yolk into two unequal Parts, so that

that the smaller Part of the Egg is, of Necessity, raised towards the Belly of the Bird that performs the Incubation; and the other Part being more gross and weighty, always descends as near to the Bottom as the Bands will permit; by which Means, should the Egg be displaced, the Young could not receive any Injury; and what ever may happen, it enjoys a Warmth that puts all about it in Action, and by Degrees compleats the Disengagement of its Parts. As it is incapable of sliding down, it nourishes itself in Ease, first with this liquid and delicate White, which is adapted to its Condition, and afterwards with the Yolk which affords a more substantial Food; and when its Bill is hardened, and he begins to be uneasy at his Confinement, he endeavours to break the Shell, and does so in Effect. After which he issues out with his Belly covered with the Yolk that nourishes him a little longer, till he has Strength enough to raise himself on his Feet, and can march about to look for Provisions, or until the Parents come themselves to supply him.

Prior. From his Lordship's Observation, that there are some Young who at their abandoning the Shell are fed by their Parents, and others that feed the

their own Provisions, I have happened on a Thought that I shall propose to the Chevalier. The Birds, who nourish their Young, have commonly very few; on the contrary, those whose Young feed themselves when they first see the Day, have sometimes Eighteen or Twenty in a Brood, and sometimes more: Of this last Kind are Quails, Pheasants, Partridges and Hens. Why then has the Dam who sustains her Young so small a Number, and why has she such a numerous Offspring, who only walks at the Head of them, and never supplies them with Food? Do you impute this Difference to the Sagacity of the Parent, or the Capriciousness of Chance?

Chevalier. There is no Capriciousness in this Conduct, but rather an extraordinary Prudence, which could only be imparted by him, who has regulated all Things to the best Advantage. The Dam who charges herself with the Care of seeking Provisions, has but an inconsiderable Brood; were it large, both the Parents would be Slaves, and the Young but indifferently accommodated. As to the Mother who marches in the Van of her Progeny, without nourishing them, she can conduct twenty

as well as four: This is a Demonstration rising before our Eyes.

Countess. 'Tis very true, Chevalier, but who has these Eyes? You make me open mine to a Truth I was not sensible of before. You tell us of one Sett of Young who are nourished by their Parents, and another who seek their own Food, but how do these latter get what they want? Have they any Market where they may be sure of finding their Provisions? And how are the Cries of the former, who cannot make Excursions for Sustenance, heard on the Spot? Has the Father of these little ones any Magazine in which he hourly finds wherewith to satisfy his whole Family?

Chevalier. They are all nourished by one common Father.

Prior. He opens the great Magazine of the Fields, where they all accommodate themselves according to their Necessities. There they find Caterpillars, Worms and Flies for their Young. They likewise, in the proper Season, meet with Beetles, Snails and Grain of all Kinds, which are their Food when they are grown strong; even Frogs, Lizards, Serpents, and those very Animals we apprehend to be most pernicious, are a delicious Regale for Storks, and

a

a Variety of other Tribes. God opens his Hand, and every Animal lives.

Countess. Here is another Instance of his Bounty, which relates to us in particular. Those Birds that are detrimental to us, and those with whose Existence we can easily dispence, are the Species that multiply the least. On the contrary, those whose Flesh is most Salutory, and whose Eggs afford the best Nourishment, are fruitful to a Prodigy. The Hen alone is a Treasure for Man: She daily makes him a Present, but such a Present as is extremely valuable. If she sometimes ceases to furnish out her Master's Table, 'tis only that she may the better recruit his Poultry; and for her Services, so frequently repeated, she demands nothing but the most insignificant Remains of his Barn and Table. It would be Ingratitude not to be sensible of the Worth of such a Domestick. But let us leave this Article, and return to the Birds.

I suppose the Eggs hatched; and now the Young makes its Appearance: The rearing of the Young. With what a new Weight of Cares are the Parents charged till the young Brood are capable of subsisting without them! They are sensible, till that Period, what it is to have the

Care of a Family. Provision must be prepared for Eight instead of Two. The Linnet and the Nightingale labour then like the rest. Adieu to Musick, 'tis no longer a Season for Singing; or at least, they indulge in it with less frequency. They are pressed by Necessity, and constantly in Quest of Provisions, sometimes one, sometimes the other, and sometimes both together. They are up before the Sun, they distribute the Food with great Equality, giving each its Portion in its turn, and never feeding one Bird twice. This Tenderneſs of the Mothers for their Young, operates to a Degree that even changes their natural Disposition. New Duties introduce new Inclinations. 'Tis not only incumbent on them to nourish; they must watch, defend and forecast; they must likewise oppose the Enemy, and hazard their own Persons in each Encounter. Follow a Hen, when she becomes the Mother of a Family, she is no longer the same Creature. Tenderneſs changes her Humours, and corrects her Imperfections. She was formerly ravenous and insatiable, but at present she no longer resembles her self. Does she find a Grain of Corn, a Crumb of Bread, or even something more considerable in Quality, and capable

capable of being divided? She never touches it: She gives Information to her Troop by a Cry which they all understand; they run to her with great Expedition, and the discovered Food is only for their Use. The Mother confines herself to great Moderation in her own Meals. This Mother, naturally timorous, and who before knew nothing but flight, is a Heroine at the Head of a Troop of Chickens; she is no longer acquainted with Danger; she springs to the very Eyes of the stoutest Dog, and is inspired with so much Courage, by her new Dignity, that she would venture to encounter a Lion.

I lately saw one of these Creatures in another Situation that was no less entertaining. I gave Directions to have some Eggs of a Duck put under her, and they were hatched to my Wish. The Young, when they quitted the Shell, had not the Form of her ordinary Brood; but she still fancied herself to be their Parent, and for that Reason was extremely pleased with them, and tended them as her own, with the greatest Fidelity. She gathered them under her Wings; cherished them with Warmth; and led them up and down with all the Authority and Privilege that flows from the Quality of a Mother. She had

had always been perfectly well respected and obeyed by the whole Brood ; but unfortunately for her Honour, a Brook appeared in the Way, and all the little Ducks were immediately in the Water. She was in a wonderful Perplexity ; she followed them with her Eyes along the Bank, gave them Council, reproached them for their Rashness, called aloud for Assistance, and uttered her Complaints to all around her. She returned to the Stream, and renewed her call to these imprudent Creatures. But the Ducklings, transported to find themselves in their proper Element, from that Moment discharged her of all future Care, and as they had then acquired Strength, they returned to her no more.

Prior. Her Ladyship will permit me to interrupt her a Moment, and ask the *Chevalier* in what School these Ducklings had learned that Water was their Element ? They certainly had not this Information from the Hen.

Chevalier. I conceive it. This Propensity to the Water is implanted in the very Nature of the Duck. 'Tis the Work of the Deity.

Prior. One cannot in such an Instance mistake the Impression of the Creator

Creator, which anticipates all Lessons, and corrects Education itself.

Countess. I must give the *Chevalier* another Instance of a Mother's Anxiety, to which I have frequently been a Witness. When a Turkey Hen appears at the Head of her Young, she is sometimes heard to send forth a mournful Cry, the Cause and Intention of which is unknown. The Brood immediately squat under Bushes, Grass or whatever else presents itself for their purpose. They intirely disappear; or if they have not a sufficient Covering, they stretch themselves on the Ground, and lie as if they were dead. They are seen to continue in this Posture, without the least Motion, a whole Quarter of an Hour, and sometimes a much longer Time. In the Mean while, the Mother directs her View upwards, with an Air of Fear and Confusion; she redoubles her Sighs, and repeats the Cry that laid all the Young prostrate. Those who observe the Disorder of this Parent, and her anxious Attention, look up into the Air to discover the Cause; and at last perceive, under the Clouds that float in the Air, a dark Point which they can hardly distinguish. This is a Bird of Prey, whose Distance withdraws him from our View, but who cannot

C 4 escape

escape either the Vigilance or Penetration of our Mistress of the Family. This Occasions her Fears, and allarms the whole Camp. I have seen one of these Creatures continue in this Agitation, and her Young couched close to the Ground, for the Space of four Hours successively ; whilst the Bird wheeled about, ascended and darted down over their Heads. But if he at length disappears, the Mother changes her Note, and utters another Cry that revives all her Brood ; they run to her, they flutter their Wings, and tender her their Caresses ; they have a hundred Things to tell her, and without doubt they relate all the Dangers to which they have been exposed. They bestow their Imprecations on the vile Bird who --- But the Subject grows too serious to engage your Attention any longer.

Prior. Every Circumstance of your Ladyship's Account is altogether worthy of Observation. Who could make this Mother acquainted with an Enemy that never injured her ; and who, as yet, had not committed any Act of Hostility in the Country ? And how could she be able to discover this Unknown at such a Distance ? Besides this what Instructions had she given her Family to make them distinguish, according

ing to the Occasion, the different Signification of her Cries; and to regulate their Behaviour by her Language? All these Wonders are daily obvious to our View, though we treat them with Inattention. In Reality, the Picture her Ladyship has drawn of them, engages me much more than some very serious Dissertations.

Countess. The *Prior*, however, must give us one on the Structure and Flight of Birds.

Prior. That I shall readily do. 'Tis a Subject perfectly agreeable to my Taste,

The * Body of a Bird is neither extremely Massive, nor equally Thick in all its Parts; but is well disposed for Flight, sharp before, and gradually increasing in Bulk, till it has acquired its just Dimensions. Such a Structure renders it more adapted to cut the Air, and make itself a Passage through that Element.

The Form of a Bird.

To qualify it for long Flights, in which Provisions are not always to be obtained; and to enable it to pass away the many Hours of Winter Nights without eating, Nature has supplied it, under the Throat, with a Bag, called the Crop, in which it reserves its Meat.

The Crop.

* Derham Theol. Phys. l. 7.

The

The
Gizzard.

The * Fluid in which this swims, facilitates its first Digestion. The Gizzard, into which no more than a very small Quantity of the Nourishment enters at one Time, performs the Rest, and frequently by the Aid of some little rugged Stones which the Bird swallows, in order to break the Texture of the Nutriment the better, and perhaps to keep the Passages clear.

The
Bones.

The Bones of Birds, though of a Solidity sufficient to sustain the System of their Body, are nevertheless so hollow and diminutive, that they scarce make any Addition to the Weight of their Flesh.

The
Feathers.

The whole Plumage is artfully formed and distributed, as well to sustain the Bird, as to defend it from the Injuries of the Air. The Quill of a Feather is altogether firm and light. It is firm, in order to cleave the Air with a proper Force: It is light and hollow in Proportion to its Growth, that the Bird may not be whelm'd downwards instead of being raised aloft. In a Word, this hollow Quill possesses a great deal of Surface with little Gravity, which places the Bird almost in Equilibrium with the Air. The Feathers are inverted behind, and laid one over another

* Willughby's Ornitholog. l. i.

in a regular Order. That Part of them which is next to the Body, is furnished with a warm and soft Down; and that which is next to the Air, is arrayed with a double Beard, in two Ranks, and longer at one End than at the other. These Beards are a Row of little flat and thin Plates or Laminæ, disposed and inserted in a Line as perfect as if their Extremities had been cut with a Pair of Cissars. Each of these Laminæ is itself a Quill or Basis which sustains two new Ranks of a Minuteness, that almost renders them invisible, and which exactly close up all the little Intervals through which the Air might be insinuated. Besides this, the Feathers are disposed in such a Manner, that the Range of the little Beards of the one, slides, plays and discovers it self more or less under the great Beards of the other Feather that lies over it. A new Rank of lesser Feathers serves as a covering to the Quills of the larger. The Air is excluded from every Part; by which Means the Impulse of the Feathers on that Fluid becomes very strong and efficacious.

But as this Oeconomy, so necessary in its Constitution, might be frequently incommoded by Rains, the Author of Nature has furnished Birds with an Expe-

Expedient that renders their Feathers as impenetrable to the Water as they are, by their Structure, to the Air. * All Birds have a Bag filled with Oil, and shaped like a Nipple, the Situation of which is at the Extremity of their Body. This Nipple has several little Apertures, and when the Bird finds her Feathers dry, soiled, discontinued by Gaps, or ready to be moistened, she presses this Nipple with her Bill, and forces out an Oil or fat Humour reserved in the Glands ; and drawing her Bill over the greatest Part of her Feathers successively, oils and dresses them, gives them a Lustre, and fills up all the Vacancies with this viscous Matter; after which, the Water only slides over the Bird, and finds all the Avenues to her Body perfectly closed. Our Poultry, who live under a Covert, have a less Quantity of this Liquor than Birds who inhabit the open Air ; for which Reason, a Hen, when she is wet, makes a ridiculous Figure : On the contrary, Swans, Geese, Ducks, Moorhens, and all Birds destined to live on the Water, have their Feathers dressed with Oil from their very Birth. Their Magazine contains a Provision of this Fluid proportionable to the Necessity of its

* Willughby's Ornitholog. l. i.

Consumption, which is continually returning; their very Flesh contracts the Flavour of it, and every one may observe that the Care of moistening their Feathers with it, is their constant Employment.

If there is so much Wisdom in the Structure of the Feathers, there is no less in the Play of the Wings and Tail, in order to traverse the Air. Nothing can be better placed than the Wings; they form on each Side two Leavers that keep the Body in a just Poise; at the same Time, they perform the Function of Oars, which by bearing on the Element that resists them, advance the Body in a contrary Direction.

The Tail is a Counterpoise to the Head and Neck, and serves the Bird instead of a Rudder, whilst he rows with his Wings; but this Rudder is not only instrumental in preserving the Equilibrium of the Flight; it likewise enables the Bird to rise, descend and turn where he pleases; for as soon as the Tail is directed to one Point, the Head turns to the opposite Quarter.

Chevalier. Though I don't comprehend how Birds perform their Flight, I am of Opinion, that it is not impracticable for Man to fly: The Birds instruct him in the Method he ought to observe.

Prior.

Prior. 'Tis certain that we have the Principle of Motion in our Legs and Arms ; we likewise have in the Feathers of Birds, and in our Linnen Cloth and Oil, the Materials that have a seeming fitness to form Wings, capable both of striking and impelling the Air, without being penetrated by it. The Birds supply us with a Model of the Action, and at first View, it seems to be an Invention naturally presented to us, and which a small Effort, or a few Reflexions, would suffice to make us acquire in Perfection ; but I believe that God, in Consequence of his providential Care of Mankind, has opposed an insuperable Impediment in the Way ; so that this Attempt, which has been frequently repeated, hath always proved unsuccessful. The Art of flying would be the greatest Calamity that could happen to Society.

Chevalier. On the contrary, Sir, I should think that this Invention would save us Abundance of Labour. We should be sooner acquainted with what we are desirous of knowing ; and if we had once found out a small Machine, we could soon build a larger. We should not only traverse the Air ourselves, but might likewise convey Car-

goes

goes of Merchandize through that Element. By this Means Commerce —

Prior. You have a charming Penetration, *Chevalier*, and are the best in the World, at guessing the Advantages we might receive from this Invention; but these Advantages would not countervail the Disorders that would be introduced.

Count. This is certain, that were Men capable of Flying, no Avenue could be made inaccessible to Vengeance and inordinate Desires. The Habitations of Mankind would be so many Theatres of Murder and Robbery. What Precautions could we take against an Enemy who would have it in his Power to surprise us both by Day and Night? How should we preserve our Money, our Furniture, and our Fruits from the Avidity of a Sett of Plunderers, furnished with good Arms to force open our Houses, and with good Wings to carry off their Booty, and elude our Pursuit? This Sort of Trade would be the Refuge of every indigent and ambitious Person.

Prior. I may add to this, that the art we are speaking of, would intirely change the Face of Nature; we should be compelled to abandon our Cities and the Country, and to bury ourselves in sub-

subterraneous Caves, or to imitate Eagles and other Birds of Prey; we should retire, like them, to inaccessible Rocks and craggy Mountains, from whence we should from Time to Time fall down upon the Fruits and Animals that accommodate our Necessities; and from the Plain, we should immediately soar up to our Dens and Charnel Rooms.

Countess. Ah! Gentlemen, you make me tremble at your Art of Flying; and I bestow, before hand, my Imprecations on the Person, whoever he be, that shall attempt to make it practicable. Let me hear no more of Dens and Charnel Rooms. Do you see, *Chevalier*, what you expose us to with your Inventions?

Count. Make your self easy on this Head. We need not be under any Apprehensions about the Art of Flying, which indeed is an absolute Impossibility; Nature herself has formed an Obstacle against it, that is in some Measure made invincible, by the exceeding Disproportion between the Weight of the Air, and an human Body. The hollow Machine that one must imagine capable of sustaining the Body of a Man, and placing it in an equal Balance with the Air, would be so immoderately

derately large and cumbersome, that learned Men have judged the Management and Use of it to be altogether impracticable, and as much forbidden to Man as the perpetual Motion.

Countess. Are you disposed, Gentlemen, to resume the Subject of Birds To-morrow?

Count. There is no want of Variety. The Difficulty lies in confining ourselves to a due Limitation. What shall be the Articles of our Entertainment?

Prior. Let each chuse what is most agreeable to his Taste, and serve it up as a Country Collation.

Chevalier. If the Prior pleases to be my Security, I will acquit myself like the Rest.

Countess. For my Part, Gentlemen, I promise you before-hand a Bird that is to be found in no Place but *America*; 'tis the least and most beautiful of all Birds, and if it should not be sufficient for you, I will make you amends with an Ostridge.





BIRDS.



DIALOGUE XI.

The Count and Countess de JONVAL.

The PRIOR and the CHEVALIER.

Chevalier.  ESTERDAY in the Evening I slip'd into his Lordship's Clofet, where I

found *Willughby's* Book lying open on the Bureau. I ran over all the different Species of Birds that are there finely graved, and illuminated after the Life, and my Thoughts turned on nothing else all the Night ; but I was particularly surprized at the immoderate Bill and Legs of an uncommon Length

Length that I observed in some, whilst others had a very short Beak, and were so contracted in their Legs, that the Extremities of their Claws were hardly discernable. After all, both the one and the other are only ordained to expatiate in the Air, and seek their Food. For what Reason then is there such a prodigious Variety in their Wings, their Bills, their Claws, and every other Part? Is all this but the Sport of Nature, or do these different Forms tend to any particular Purpose?

Count. The Inequality you observe in the Bill of one Bird and that of another, does not correspond with the Differences you discover in the Noses of Men; for in these, an Inch more or less constitutes all the Diversity between the longest and the shortest in every other Particular, the Structure and Use are the same; whereas in the various Species of Animals, the Bill, the Tallons, the Dimensions of their Wings, and generally all the Parts of their Bodies, are calculated for the Accommodation of their Wants. They are a Sett of Implements proportioned to the Nature of their Labours, and their Manner of Life. A few Instances will be sufficient to justify my Sentiments. Sparrows, and the Generality of

D 2

of small Birds, are supported by the little Grains they find either in our Houses or the Country. They have no Efforts to make, in order to obtain their Food or to break it in Pieces, and therefore they have a small Bill, their Neck and Legs are very short, and this suffices their Purpose. But the Case is different with Respect to the Woodcock, the Snipe, the Curlew, and a Variety of others who seek for their Aliment very deep in the Earth, and in Slime, from whence they draw the little Shell Fish and Worms that sustain them. Nature has supplied these Creatures with a very long Neck and Bill; and with these Instruments they dig, and search, and want for nothing.

The
Wood-
cock.

The
Wood-
pecker.

The Woodpecker, who lives in a very different Manner, is therefore as different in the Structure of his Body. His Bill is very long, and of an extraordinary Strength and Solidity; his Tongue is sharp, extremely long, and besides that, is armed with little Points, and always covered with Glee towards its Extremity. He has short Legs, two Talons before, and as many behind, and all of them very crooked. All this Equipage relates to its Manner of living, and obtaining its Prey. This Bird derives its Subsistence from little Worms





A. The Woodpecker darting
 D. The Woodcock E. The Snow



into the Cavity of a Branch B. The Heron C. The Curlew
 Nightingale G. The Peacock H. The humming bird I. The Owl.



The illustration is a faint, light-colored drawing of a bird, possibly a peacock or pheasant, standing and facing left. The bird has a long neck, a small crest, and a long tail. The illustration is enclosed in a faint rectangular border.

or Insects that live in the Heart of certain Branches, and most commonly under the Bark of old Wood. 'Tis very usual to find the Retreats of these little Animals sunk very deep in large Billets, under the Bark which easily peels off. The Woodpecker should be provided with hooked Claws, in order to grasp the Branches where he fastens. Long Legs would be useless to him, for his Attainment of what lies under the Bark; but a strong and pointed Bill was necessary for him to find out, by darting it up and down the Branches, what Places are void and rotten. He stops where the Branch sounds hollow, and with his Bill shatters the Bark and Wood; after which, he thrusts his Bill into the Orifice he has made, and sends forth a loud Cry, or a kind of whistling Sound into the Cavity of the Tree, in order to disengage the Insects who sleep there, and put them in Motion. He then thrusts his Tongue into the Aperture, and by the Assistance of the little Points that rise out of his Tongue, and the Glew that rolls over it, he draws out all the little Animals he finds there, and regales himself with the Prey.

The Heron, quite contrary to the The Woodpecker, is mounted aloft, his Legs Heron

and Thighs are very long, and intirely destitute of Plumage ; he has a great Length of Neck, an enormous Bill, very sharp and jagged at the Extremity. What Reasons can be assigned for a Figure that at first seems so extravagant ? The Heron feeds on Frogs, little Shell Fish, as well as other Fish, that he can find in Fens, or near the Shores of Rivers and the Sea. He wants no Feathers on his Thighs to enable him to march through the Water and Slime ; but very tall Legs are exceedingly useful to him, as they qualify him for running more or less in the Water along the Shores where the Fish usually resort for their Food. A long Neck and Bill make him capable of pursuing and seizing his Prey at a considerable Distance ; the crooked Turn and Jag of his Bill, that bend like Hooks, enable him to detain the Fish that would otherwise slide away and escape him. In a Word, his large Wings that should seem incommodious to so small an Animal as an Heron, are infinitely assitant to him in making great Movements in the Air, and conveying weighty Burdens to his Nest, which is sometime seated one or two Leagues from the Place where he fishes. A Friend of mine who has an Estate in *Abbeville*, and

which

which is bounded by a little River, plentifully stored with Eels, saw a Heron one Day carry off one of the largest of those Creatures into his Heronery, in Spite of all the Efforts and Undulations of the Eel to oppose his Flight. What we have observed of the Heron is applicable to several other Species which resemble him.

Countess. This is the first Time that I have heard any Observations made on the Use of all these Bills, which till now seemed a little extravagant to me. But I am sensible that the Imperfection belongs to me, and that all our Censures of Nature are really so many Confessions of our own Ignorance. I don't know, for Instance, wherein the prodigious Bill of a Stork can be serviceable; but I shall never prevail on my self to cavil at it.

Prior. She digs into the Earth with ^{The} it for Serpents and Adders, which she ^{Stork.} afterwards conveys to her Young, to whom the Poison of these Animals is perfectly inoffensive.

Countess. Its just Proportion is now very evident, and in reasoning on this Subject, methinks I shall be able to guess why the Swans we see below on ^{The} the Canal have a long Neck and a broad ^{Swan.} Bill. Swans, Geese and Ducks are per- ^{Geese and} petually ^{Ducks.}

petually raking at the Bottom of the Water, because they there find some of the little Vermine or Worms you spoke of the other Day. As they are perpetually swimming, without being able to sink, they ought to have a long Neck capable of extending to the Bottom; and should they not, quite contrary to other Birds, have a very broad Bill to take in at one Time a larger Quantity of Slime or Gravel, and seize all the Worms that are to be found there, by separating them from the other Matter in which they are taken? I even suspect that the upper Part of their Bill is pierced, in order that the Water may be discharged through that Opening, and that they may only swallow the Fish or Insect they have taken. Instead of those crooked Talons, with which Birds who feed on Flesh are able to seize and turn their Prey, and fasten on the Branches where they settle, Swans, Geese and Ducks have flat Feet or large Paws, accommodated with Films or Skins, which they extend in the Form of Fins, and with which they impel the Water one Way that they may advance another. The *Prior* sees I am mighty sagacious. All this is very difficult to be explained.

Prior.

Prior. The Merit of Natural Philosophers, Madam, among whom we rank you at present, does not always consist in solving Difficulties ; but rather, in turning their Eyes on Points that are unobserved by others, and which are commonly treated with Contempt. Nothing is more unusual than to meet with People who think and reflect.

Countess. We Women are discharged from that Care. It seems the Men do not usually expect Thought from us. Among them, a little shining Liveliness supplies us with every necessary Accomplishment.

Prior. I must confess their Indulgence is very great in this Particular, and you have no Occasion to complain of them.

Countess. On the contrary, permit me to tell you, that we have infinite Reason to complain of such a Proceeding. We receive irreparable Injury from the Misapplication of this Indulgence ; 'tis this which renders us vain, indolent, incapable of Elevation, ignorant, unpenetrating, and inconstant ; and we may be certain, that the Men, by the Conduct they observe with Respect to us, labour to form in our Minds all those Imperfections for which they reproach us. Is it not one of the Maxims of their Politeness, to entertain us with

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with nothing but Trifles? In the Language we receive from them, and the Affiduities with which they treat us, it is evident that they regard us either as Children or Idols. Their Conversation with us is always confined to Modes or Play, and a certain polite Jargon. 'Tis a kind of Miracle when any one of our Sex preserves her Understanding from the common Wreck, and discovers a little Justness and Solidity. We sustain no great Loss by not being instructed in the ancient Languages, and I have a perfect Indifference for those learned Researches and gloomy Sciences; which by an immoderate Application to them, make us useless to Society: But our Fate is to be lamented, in that, the Generality of us have no solid Knowledge of our Religion; no Acquaintance with the History of Mankind, which is also the History of the Heart of Man; and scarce any Idea of the Works of the Deity. For my Part, I assure you, that the People I have met with seem'd to have enter'd into a Combination to ruin the little good Sense that might be discoverable in me. The *Count* is the first who did me the Justice to believe I had my Share of Reason as well as the Rest. It was evident, by the Conversation with

with which he entertained me, that he is perswaded I am capable of Thinking ; and is it not doing me Honour, to believe me not unworthy to hear Discourses on Things that every where present themselves to our View, or which are most essential to Life ; to know why a Tree rises in such a Shape ; to be acquainted with the Cultivations of the Earth, and the Qualities of a Plant that springs at our Feet when we are walking ? Since his Lordship has led me into a Habit of thinking and employing my self, my Country Seat has seemed to me an earthly Paradise. I enjoy Beauties and Treasures with which Nature abounds, but which were so many lost Treasures to me, when I was not so much as acquainted with their Names.

Count. Your Complaints against our Sex are without doubt very justly founded. But I cannot say the same with Respect to your Confession of the disagreeable Qualities of the Ladies. There are certainly great Numbers of them, in whom good Sense is the prevailing Accomplishment ; and whose Understanding is as judicious as it is delicate ; whether they owe this Solidity to an happy Cultivation, or whether the Fineness of their Genius rectifies the Defects of a weak Education. But whilst

whilst you are lamenting the Ladies Fate, and I am offering an Apology for them, we take no Notice that the Poor *Chevalier* is half a sleep.

Countess. He is not to be blamed. I have promised him a Couple of Outlandish Birds, and instead of them I give him a Lecture in Morality. What I am now going, Sir, to acquaint you with, I had from a Merchant of *St. Malo*, a great Traveller, and one who had contracted with my Lord, to furnish his Cabinet with foreign Curiosities. Six Months ago he paid us a Visit at his Return from a new Voyage he had made to *America*, and the Coasts of *Guinea*. He presented me with four Humming Birds, and two Eggs of an Ostridge, and informed us of several entertaining Particulars of these Creatures.

The
Hum-
ming
Bird.

The * Humming Bird is peculiar to *America*, and may pass for a little Miracle of Nature, both for its Manner of living, and its Smallness. It is not bigger than a large Fly, but is decked with such a beautiful Plumage, that its Neck and Wings resemble the Rainbow. His Neck is tinged with such a glowing Red, that one might imagine

* Biblioth. univ. & hist. Aout. 1687. Observ. Cur. Tom. II.

it to be a Ruby. The Belly and nether Part of the Wings are as yellow as Gold; and the Thighs appear as green as an Emerald; the Feet and Bill are black and polish'd like Ebony. The Eyes are like two oval Diamonds, and of the Colour of polished Steel. The Head is Green intermixed with Gold of a surprising Lustre. A little Tuft rises on the Head of the Males, and is an Assemblage of all the Colours that shine in the other Parts of the Body. These Birds fly so swiftly, that they are rather heard than seen. We are told that Dews and the Juices of Flowers are their Food, which they extract with their little Tongue, whose Length exceeds that of their Bill, and serves them instead of a Trunk, which they contract and sheathe in their Bill. This Bill, which is not larger than a fine Needle, makes them formidable to the great Birds that are called Grosbeg, and who endeavour to surprise the Young of the Humming Bird in their Nest; but when the Dam makes her Appearance, the Grosbeg flies off, and cries with all its Might, because he is sensible what sort of an Enemy he has to contend with. The Humming Bird pursues him close, and if he can come up with him, fastens himself with his little Talons under

under the Wing of the Grosbeag, and pierces him with his pointed Beak till he has made him incapable of the Combat. You may see in that little Box two of these pretty Birds, who, though they have been sufficiently dried, retain still a considerable Part of their rich Colours. You see they are hung by their little Feet to a small Ring of Gold in the Form of Pendants, because the Ladies of *Mexico* apply them to that Use; and it must be confessed that no Pearls can equal them in Beauty.

Chevalier. These are Birds in Miniature indeed. Your Butterflies can't shew more amiable Colours: But, Madam, I should be glad to know if this charming Scent is natural to them.

Countess. Several People believe it proceeds from the Juices of the Flowers that nourish them; but my Merchant is of Opinion, that a little Ambergreece, or fragrant Gum is wrapped in the Cotton, with which they are filled for their better Preservation.

Chevalier. We wait to hear, Madam what he likewise told you of the Ostridge.

Countess. This is one of the largest * Birds in the World, and they are more numerous in *Africa* than in any other

* Willabygh's Ornithol. lib. xii.



The Ostrich. B. The Eagle. C. The Hawk.



Country : Her Head rises as high as a Man on Horseback, and sometimes higher : Her Head and Bill resemble those of a Duck : Her Neck is like that of a Swan, but greatly exceeds it in Length : Her Body bears some Similitude to the Camel's, having like that Creature a Bunch rising on the Back. The two Wings of the Ostridge are very strong, but too short to raise her from the Ground, and * they only serve her instead of Sails or Oars to enable her to cut through and impel the Air, and add an extraordinary Swiftneſs to her Flight. She has the Legs and Thighs of an Heron, Allowance being made for the different Proportion ; each Foot reſts on three Claws armed with Horn, to facilitate her March.

Her Eggs are as big as an Infant's Head : The Shell has Veins drawn over its Surface like Marble, is very ſhining, and perfectly well poliſhed. I will ſhew you a Couple that were preſented to me. 'Tis the Cuſtom of the Oſtridge to hide them inconfiderately in the Sand ; and, as we are told, † to leave the Care of hatching them to the Sun. This Diſpoſition that ſeems to manifeſt

* Diodor. Sicil. lib. iii.

† Job 39. 16. Lamentations of Jerem. c. iv. v. 3.

so much Disregard to her Young, has acquired her no extraordinary Reputation. In all Countries where she is known, when they would speak of a Mother who has but little Tenderneſs for her Children, they compare her to the Oſtride.

Some * Travellers, as my Merchant informed me, have endeavoured to excuse her, and affirmed that she is careful to leave a Quantity of Worms near her Eggs, that her Young may find proper Nourishment when they issue from the Shell. Some have pretended to discover an admirable Discernment in the Oſtride, which † inclines her carefully to warm those of her Eggs that are to be prolifick, and to neglect the rest that they may serve for Nourishment to her Young when they come to be hatched. But this has a considerable cast of the Fable; and it must be acknowledged, that the Prudence of other Animals is not visible in the Oſtride. She leaves her Eggs in the Sand, liable to be crushed by the Feet of Passengers, which is no extraordinary Instance of Precaution: But another Circumstance that has given Birth to the Remark that her Conduct is not regulated by

* Derham, Theol. Phys. lib. iv. c. xv. & lib. vii. c.

† Elian. Hist. lib. xiv. c. 7. & lib. iv. c. 37.

the Brain, is this, when she is pursued by the Hunters; she runs to hide her Head, and particularly her Eyes, behind a Tree: All the rest of her large Body is exposed to View, but as she no longer sees the Hunter, she imagines that to be sufficient, and believes she has nothing to apprehend.

Chevalier. Is it true, my Lord, that Ostridges eat and digest Iron, as I have heard?

Count. It is certain that they swallow small Pieces of that Metal as other Birds swallow pebble Stones, but they are not digested by these Animals, and if they swallow them, 'tis not to derive any Nourishment from them, but only to bruise and grind the Food in their Stomach, to moderate the Operation of an excessive Heat, and, by its Weight, to open the Passages into the Intestines.

Countess. Before we leave the Ostridge, who has had but an indifferent Character from us, let us relate all the advantageous Things of her that we can. She furnishes us with most lovely Feathers, very broad and long, some white, others black, but which are tinged by Art with all the Variety of Colours: They are placed as Ornaments on the Testers of Beds, the Canopies of great Men, and the Caps of Children:

E

They

They adorn the Hats of Gentlemen, and furnish the *English* Ladies with very pretty Fans: They add Height to the Stature of Tragedians, and it must be confessed, that the Theatrical Heroes would lose a considerable Part of their Grandeur, were they to be divested of the Ostridges Feathers.

Gentlemen, I have presented you with the least and largest of all Birds. You may fix your Choice between these two Extreams; the Field is very spacious.

Prior. 'Tis so spacious, that I am intirely lost, and own myself confounded by the very Abundance I discover.

Countess. Since all Subjects are alike to you, let me appoint each his Part. The *Prior*, as he is a Man of good Taste, ought to charge himself with the Recommendation of Birds that are valuable, either for the Melody of their Notes, or the Beauty of their Plumes. But he shall be released from this Task, when he has favoured us with a few Words on the Nightingale and Peacock; and he will hardly complain of the Part allotted him. His Lordship, as he is a great Sportsman, should present us with Birds of Prey; and the *Chevalier* has told me, in a Whilper, that he has reserved the Birds of Passage for our Entertainment. In my Opinion, these are all

all the Species, unless any one has an Inclination to add the Bat and the Owl.

Prior. Of all the Classes of Birds, none prove more agreeable Companions to Man than those who enjoy the Gift of Harmony and Speech. But what Pleasures soever they administer, they are all Foils to the Nightingale, who alone charms us as much as the whole Band of the other Species. After we have listened to the most melodious Symphony, we are agreeably surpris'd to hear an excellent Violin, unaccompanied by any other Instrument. Let Monsieur *Baptist*, in the midst of a fine Concert, begin to play a Solo, and enchant us with some of those Strokes of his Bow that distinguish him, every Ear is all Attention; we admire the extraordinary Force with which he draws and modulates his Tones, nor are we less affected with the exceeding Softness that is inseparable from them: He always knows how to diversify his Play; and his Performance receives an infinite Contrast from that which preceded, and communicates Agreeableness and Value before hand, to that which is to follow. He leads the Ear from Wonder to Wonder. All the Audience is struck with the Charms of the Harmony; and

the most scrupulous Judges, perceive throughout the whole a Multitude and Justness of Proportions that entertain them, with an intire Orchestre in a single Instrument. 'Tis the very same in a Concert of Birds: After we have heard a full Chorus celebrate the Author of Nature, and proclaim the Bounties of him who sustains them, 'tis an agreeable Novelty, in the Evening, to hear the Nightingale begin to sing by himself and continue his Notes till the Night is far advanced. One would imagine that he is sensible of the Merit of his Accomplishments; and that it is in Complaisance to Man, as well as for his own Satisfaction, that he is pleased to sing when all the rest are silent. Nothing animates him so much as the Stillness of Nature. 'Tis then that he composes and executes all his Tones. He rises from Seriousness to Gaiety, and from a simple Song to a more sportive Warbling; from the lightest Quavers and Divisions, he softens into the most languishing and plaintive Sighs, which he afterwards forsakes to return to his natural Sprightfulness. One is often tempted to gain a View of the amiable Musician that so obligingly amuses us each Morn and Evening. We search for him, and still he

he conceals himself. A great Genius has its capricious Peculiarities. When we only hear him, our Imagination is apt to lend him a stately Shape. It should seem that he ought to have a vigorous Breast, and indefatigable Organs, to furnish out and sustain for many Hours without languishing, such a Strength and gracefulness of Sound, such multiplied and striking Proportions, and, in a Word, such a prodigious Variety of Musick; and yet we find that it is the Throat of a very little Bird, who, without a Master, Study or Preparation, accomplishes all these Wonders.

What the Nightingale is to the Ear, The Peacock. the Peacock is to the Eye. It must be granted that the Cock, the Wild Duck, the Kings-fisher, the Goldfinch, the Parrot, and a Variety of other Birds, are very finely array'd, and that we are delighted with the Consideration of their Ornaments, and the elegant Taste of their different Vestures; but when the Peacock appears, every Eye is allured. The Air of his Head; the easy Turn of his Shape; the blended Colours of his Body; the Eyes and clouded Spots of his Tail; the Gold and Azure that shine in every Part; the Round of Plumage that he draws

E 3 after

after him ; his Aspect full of Dignity, and the very Attention with which he unfolds his Ornaments to the Spectators, whom Curiosity assembles about him, have a singular and ravishing Effect. This Bird alone is a noble Spectacle ; but would you imagine that he had any thing belonging to him that could be disagreeable ? However, this is the Fatality of the Peacock, he dissatisfies all his Beholders : He can neither talk nor sing ; his Language is shocking, 'tis a Cry capable of inspiring one with Horror ; whereas the Linnet, the Thistle-Finch and the Parrot, with all the modestest and most simple Accomplishments, live with us fifteen or sixteen Years without giving us a Moment's Disgust ; they are Creatures of Understanding and good Behaviour, and that is saying every Thing to their Advantage. The least of their Qualifications is a pompous Exterior which renders their Society agreeable and of a long Duration.

I have expatiated, perhaps, too much on the Articles of Adjustments and Musick ; these Particulars have but little Relation to my Profession. It will be more graceful for his Lordship to entertain us with Faulconry, for that is the real Province of a Gentleman.

Court

Count. This Sport is one of the noblest, and frequently one of the most profitable Pleasures. Mankind have discovered the Secret of making even the voracious Quality of Birds advantageous, either by employing them against those who are called Malignants, because they are always warring with the most timorous Species, (of this destructive Class are Kites and Ravens, who attack only Pigeons and Chickens) or else by employing them against those Birds whose Flesh affords the most exquisite Relish, but who live at a great Distance from us; such are the Partridge and Pheasant. For these different Sports, the Faulcon, the Gerfaulcon, the Lanner, the Saker, the Merlin, the Sparhawk and Gofshawk are much esteemed: But in general, the Faulcon and Gofshawk are more serviceable and more frequently used than the rest. The Faulcon, and all those which I named first, spring into the Air with great Rapidity; and they are employed in different Flights, some of which are pointed against the Heron, others against the Kite, the Curlew, and the Owl. But these Pleasures are very expensive, and only fit for Kings or Princes. The Hawk is useful in low Flights: He is sagacious and very dex-

E 4

terous

terous in attacking the Partridge, and is sure to furnish the Larder with excellent Game. A prudent Gentleman leaves the Faulcon to Princes, and contents himself with the Hawk.

The Manner of training up a Bird of Prey.

The Manner of training them up, and employing them, is very agreeable. Those who are brought up for this Exercise, are either Nias or Hagard Birds. Those are called Nias Birds, who have been taken in the Nest, and Hagards are those who have enjoyed Liberty before they were caught. These last are tamed with more Difficulty, but Patience and Dexterity succeed in that Particular, and, in Terms of Faulconry, make them tractable and fit for the Fray. When they are too wild, they are not fed or suffer'd to sleep for three or four Days, and as many Nights, and are never left alone; by which means they grow familiar with the Falconer, and are obedient to all his Commands. His principal Care is to accustom them to settle on his Fist; to spring when he throws them off; to know his Voice, his Singing, or any other Signal he gives them; and to return to order on his Fist. At first they are tied with a String of about thirty Feet in Length, to prevent them from flying away when they are *reclaimed*; and they

they are not freed from this Confinement till they are compleatly disciplin-
ed, and always return at the Recall. To
accomplish this, the Bird must be lu-
red; and I shall now acquaint you with
the Nature of a Lure.

A Lure is a Piece of Stuff or red
Wood, on which are fixed a Bill, Tal-
lons and Wings. To this is likewise fas-
tened a Piece of that Flesh which the
Bird feeds on; and the Lure is thrown
out to him when they intend to reclaim
or recall him. The Sight of the Food
he loves, with the Addition of a cer-
tain Noise, immediately brings him
back. In a little Time the Voice alone
is sufficient. The various Plumage
with which the Lure is set off is called
a Drawer. When they would accustom
the Hawk to fly at a Kite, a Heron or
a Partridge, they change the Drawer
according to the Game in View. When
he is to spring at a Kite, they only fix
the Bill and Feathers of that Bird on
the Lure; the same Care is taken with
respect to the rest. And in order to en-
tice the Bird to his Object, they fasten to
the Lure a Slice of the Flesh of a Chick-
en, or some other Fowl, but always con-
ceal it under the Drawer or the Feathers
of the Game they propose to fly at;
to this they add Sugar, Cinnamon, Mar-
row,

row, and other Flavours proper to determine the Hawk to one particular Flight rather than another; by which Means, when he is afterwards to spring at any real Game, he falls upon his Prey with a surprizing Precipitation. After three Weeks or a Month's Exercise in a Chamber or Garden, they begin to make an Experiment of the Bird in the open Fields, and fasten little Bells to his Feet, in order to be more readily inform'd of his Motions. He is always cap'd; that is to say, his Head is cover'd with Leather that falls down over his Eyes to prevent him from seeing any Object but that which they would have him discover; and as soon as the Dogs either stop or spring the Game they are in quest of, the Falconer uncaps the Bird, and tosses him into the Air after his Prey. 'Tis then very diverting to see him wing the Air in all the Varieties of Flight; and behold him soaring by Degrees and repeated Springs, till the Eye looses him in the middle Region. He then commands the Plain; he contemplates the Motions of his Prey, whom the Distance of its Enemy deludes into an imaginary Security, and then he launches upon it with the Rapidity of an Arrow, and bears it to his Master who recalls him. They

They never fail in these his first Essays to present him, when he returns to the Fist, with the Neck and Entrails of the Prey he has brought. These Gratuities, and the other Caresses of the Falconner, animate the Bird to perform his Duty; they keep him in Regularity and good Temper, and particularly prevent him from *bearing away his Bells*; that is to say, from flying off so as to return no more, which is an Accident that sometimes happens.

But I am very much in the Wrong to entertain the *Chevalier* with a Diversion which without Doubt he has frequently seen.

Chevalier. I have beheld this Sport with Pleasure, but was never acquainted with the Manner of training up the Bird; and should be glad to know how the Gentleman, who is your Neighbour, teaches his Hawks to fly at Hares and Rabbits, as well as any other Game.

Count. This is what they call flying a Hawk at the Furr; and, there are some Hawks who are taught to fly at the Furr and the Plume; that is to say, they are trained up to fly at a Hare as well as a Pheasant or any other Game. The Difficulty is not great. When the Hawk is very tame, they take a living Hare and break one of his Legs, or else they

they make use of an Hare's Skin stuffed with Straw ; and after they have fixed to it a Piece of Chickens Flesh, or whatever the Hawk loves best, they tie this Skin with a little Cord of a great Length, the End of which is fastened to the Girth of a Horse ; and as the Skin is dragged along by that Creature, the Bird imagines it to be a Hare in flight, which allures him to dart upon it ; and by this Means he is taught to distinguish that Animal.

The Gentleman you mentioned has still a better Method. He has taught Hawks to flie at a Roebuck, a Wild Boar, and even a Wolf ; which is sometimes very serviceable when the Wolves multiply their Breed. The Manner in which he proceeds is this :

He * accustoms his young Hawks betimes to eat what is prepared for them in the Sockets of the Eyes of a Wolf, a Boar, or some other wild Beast ; for which Purpose, he preserves the Head and Skin of the first Animal he can kill, and stuffs it in such a Manner that the Creature seems to be alive, and the Hawks have nothing to eat but what they pick out of the Cavity of the Eyes ; when this is done, he begins

* Gamelli Carreri. Tom. II. p. 253.

to move this Figure gradually whilst the Hawk is feeding. The Bird learns to fasten itself to it though the Beast is drawn backwards and forwards with a very precipitate Motion. He would lose his Meal were he to quit his Hold, which makes him industrious and attentive to fix himself well on the Skull, that he may dig his Bill into the Eye, notwithstanding the Motion. When these first Exercises are over, our Gentleman places the Carcass on a Cart drawn by a Horse in full Speed. The Bird follows it, and is perpetually feeding; and when they come to flie him in the Field, he never fails to dart on the first Beast he discovers, and immediately fastens on his Head, in order to scoop out his Eyes; this throws the Creature into Agonies, he stops and gives the Hunter Time to approach and kill him without any Danger, because the Beast is more engaged with the Bird than the Sportsman.

Chevalier. 'Tis not in the Power of Dogs to perform the Services we receive from such Birds.

Prior. Greater Feats than this are sometimes accomplished; and * Eagles are beneficial to some People, without

* *Memoirs de la vie de M. Aug. de Thou. l. iv. p. 157. Raii Synops. Method. avium. p. 6.*

being

being tamed. I knew a Gentleman who kept an excellent Table, and had only an Eagle for his Steward, for he supplied him with all the Dainties that were served up.

Chevalier. Had this Steward a good Salary?

Prior. You shall hear his Services, and his Gratuity. In a Journey of mine, that I have already given you some Account of, I was in Company with a very curious Nobleman who had an Inclination to see the Antiquities of *Nismes* before he came to *Marseilles*. We took our Rout through *St. Flour* in order to proceed from thence to *Mende* in the *Gevaudan*, and cross the *Cevennes*. As he was charged with a Commission from Court, he was every where received with particular Marks of Distinction. An Officer of Note in the Neighbourhood of *Mende* invited him to pass a few Days at his Seat, and entertain'd him in the politest Manner he was able. At the first Collation he gave us, we observed with some Surprize, that all the Wild Fowl that were brought to Table wanted either a Head, a Wing, a Leg or some other Part, which occasioned our Gentleman to say very agreeably, that we must Pardon the Voraciousness of his Caterer, who was always
the

the first that tasted what he had prepared. When we asked him who this Caterer might be, and he perceived that we grew facetious at this new Mode of Entertainment, he expressed himself in this Manner. In these Mountainous Parts, which are the richest in the Kingdom by Reason of their Fertility, the Eagles are accustomed to build their Nests in the Cavities of some inaccessible Rock, which is hardly to be ascended by the Aid of Ladders and grappling Irons. As soon as the Shepherds have made this Discovery, they build a little Hut at the Foot of the Rock, where they screen themselves from the Fury of these dangerous Birds when they convey Provision to their Young. The Male carefully nourishes them for the Space of three Months, and the Female is engaged in the same Employment till the Bird is capable of quitting the Nest; but when that Period is compleated, they make him spring into the Air and bear him up with their Wings and Tallons when he is in Danger of falling. Whilst the Young Eagle continues in the Nest, the Parents ravage all the neighbouring Country: Capons, Chickens, Ducks, Lambs, Kids, and Pigs, suffer on this Occasion; they seize whatever falls in their

their Way, and bear it to their Young. But the Fields and Woods supply them with their best Game; for there they destroy Pheasants, Partridges, Woodcocks, Wild Ducks, Hares and young Fawns. The Shepherds, at the very Instant they perceive the old Birds have left the Nest, plant their Ladders and climb the Rocks as well as they are able; after which they carry off what the Eagles have conveyed to their Young; and in the Room of what they take, leave the Entrails of certain Animals. But as this cannot be done so expeditiously as to prevent the young Eagles from devouring Part of their Food, the Shepherds must necessarily bring away what has been already mutilated; but in Recompence for this Disadvantage, what they thus take has a much finer Flavour than any thing the Markets afford. The Gentleman added, that when the young Eagle has Strength enough to fly, which requires a considerable Time to attain, because he is deprived of an excellent Food, and obliged to take up with that which is very indifferent, the Shepherds fasten him to the Nest, that the Parent Bird may continue to supply him with what they take, till the disagreeable Task of providing for an Offspring that perpetually

tually fatigues them, obliges first the Male and then the Female to forsake him. The Male transfers himself to a new Situation, and the Female follows the Track of her faithful Mate ; after which, their Tenderneſs for another Progeny makes them forget the former, whom the Shepherds leave in the Nest to ſtarve, unleſs they are compaſſionate enough to remove him.

This is a Fact we were aſſured of by the Gentleman, who acquainted us, that three or four of theſe Nests were ſufficient to furniſh a ſplendid Table throughout the Year ; and inſtead of murmuring at the Creator of Eagles and Vultures, he thought himſelf very happy in their Neighbourhood, and reckoned every Nest of an Eagle or Vulture on his Eſtate equivalent to an annual Rent.

Count. Since the Converſation turns on Eagles, I muſt acquaint the *Prior* that we have a young one in Company who already begins to fly alone: I mean the *Chevalier*, who came this Morning into my Cabinet to read and make Examinations, confront Authors, and write and compoſe. We have nothing now to do but to leave him to himſelf.

Chevalier. Call me rather a Nias Hawk who has never ſeen any thing. —

I was anxious to know what became of Swallows and such a Multitude of other Birds we see for a Season, and which suddenly disappear; and I shall now declare what I have collected on that Article.

Birds of
Passage.

Some Birds of Passage delight in cold Countries, others are pleased with temperate Climates, or even with the hottest Regions. Some Species content themselves with passing from one Country to another where the Air or Aliment attracts them at a certain Season. The Birds of Passage that are most known are Quails, Swallows, Wild Ducks, Plovers, Woodcocks and Cranes; but there are several other Species.

In the Spring, Quails pass from *Africa* into *Europe* to find a more tolerable and moderate Summer than they could enjoy in the Country from whence they came. * Towards the Close of Autumn they return over the *Mediterranean* to obtain in *Barbary* and *Egypt* a gentle Heat corresponding to the Climates they abandoned when the Sun had passed the Equator. The Quails take their Flight in Troops that sometimes resemble Clouds: They frequently cover Ships and the Sailors take them without any Difficulty.

* Bellon.

Swallow

Swallows seem to have a different ^{Swallows.} Procedure. Multitudes of them, as it is pretended, cross the Sea: But the Accounts from *England* and *Sweden* make it evident, that several, or at least those of the most northern Countries, continue in *Europe*, and conceal themselves in the Caverns of the Earth, rivited to one another with their Claws and Bills. * They flock to Places unfrequented by Man, or even bury themselves in the Water. The Precaution they take to lubricate their Feathers with their own Oil, and to roll themselves up like a Ball, their Head within, and their Back without, preserves them in the Water, and even under the Ice. They are there benum'd, and pass the whole Winter without Motion. The Heart however has a constant Palpitation, and the Warmth unchills them at the Return of Spring. They then return to their former Habitations, and each Individual finds out his own Country, and his particular Village, City and Nest.

As to Wild Ducks and Cranes, both the one and the other at the Approach of Winter fly in Quest of more favour-

* See the Account given to the Royal Society at London, 12 Feb. 1713. Philosophical Transactions and Journal of the Learned 1666, and 1667.

able Climates. They all assemble at a certain Day like Swallows and Quails. They decamp at the same Time, and 'tis very agreeable to observe their Flight. They generally range themselves in a long Column like an I or in two Lines united in a Point like a V reversed. The Duck or Quail that forms the Point, cuts the Air, and facilitates a Passage to those that follow; but he is charged with this Commission only for a certain Time, at the Conclusion of which he wheels into the Rear, and another takes his Post. They have the Reputation of many other Dexterities; but his Lordship has advised me not to be too credulous in that Particular, and has consequently abridged my Quotations.

Countess. I have frequently heard People talk of a Species of little Men a Foot and an half high, who, as they say, make War with the Cranes at their Arrival on the Coasts of the Red Sea. I think they call them Pygmies.

Prior. These little Men are the Apes who battle the Cranes in Defence of their Young, which these Birds endeavour to destroy.

Countess. Though it has been familiar to me every Autumn to take Notice of a certain Day when the Swallows

meet

meet in order to depart all together, and though I have frequently seen Flights of Birds on their Journey, I always thought the Fact very miraculous. In their Progress over Seas and Kingdoms, I was at a loss whether I should most admire the Force that sustains them in so long a Passage, or the Order in which the Whole is accomplished. Who acquainted their Young that it would soon be necessary for them to forsake the Land of their Nativity, and travel into a strange Country? Which of them takes the Charge of assembling the Council to fix the Day of their Departure? Who sounds the Trumpet to inform the Tribe of the Resolution that has been taken, that each Party may be prepared? Whence have they their Almanack to instruct them in the Season and Day when they are to be in Motion? Are they provided with Magistrates to preserve the Discipline which is so extraordinary among them? For not one of them dislodges till the Proclamation has been published. * Have they Charts to regulate their Voyage by? Are they acquainted with the Islands where they may rest and meet with Refreshments? Are they furnished with a Compass to

* Explic. de l'ouv. des 6 jours.

guide them infallibly to the Coast they would steer to without being disconcerted in their Flight by Rains, or Winds, or the dismal Obscurity of many Nights? Or are they endew'd with a Reason superior to that of Man, who has not Courage to attempt such a Passage without a Multitude of Machines, Precautions and Provisions?

Prior. 'Tis very certain, Madam, that they have neither Charts nor Compass nor Reason, the Deity alone is their Conductor, on each of them he impresses a particular Method and a Train of Sentiments that suffice for their Condition. If these Operations were productive of a Reason that was proper and personal to them; if God had abandoned them to their particular Understanding, that very Faculty which appears in them so admirable and extensive, would not always be subject to the same Formality of Action.

Count. Without doubt, for all the Individuals of the same Species, if they had the same Rule and Principle of Conduct that we possess, would vary in their Apprehensions like ourselves. The Swallows in *China* would not build like those in *France*: The *Asiatic*, the *Greek*, and the *Roman* Taste, would prevail among them; and as the two latter

latter would be cultivated by the Swallows of *Italy* and *France*, these would look with Compassion on the *Chinese* Architecture ; and even in *France*, the Swallows of *Paris* would not build and live like their Provincial Brethren ; without Doubt they would follow the Mode, and communicate it to the others ; they would afterwards despise that very Mode as a ridiculous and *Gothick* Taste, when they had once taken it into their Heads to establish another. Were Swallows possessed of Reason, it would introduce Subordination. The most rational or enterprising among them would doubtless acquire the first Station in the Community ; and by a necessary Consequence, the Swallows of Distinction would not mix with the Vulgar, but leave the Labour to them. They would make a serious Affair of chirping with greater Delicacy than the rest ; they would refine on the Manner of polishing their Feathers and adjusting their Behaviour ; they would assume what is called a fine Air, and those who made the latest Appearance would be more graceful than their Elders. In a Word, if Swallows had the Faculty of Reason, they would perpetually invent, reform and perfect, and like ourselves, do a thousand rational

and important Things, of which at present they have not the least Idea.

Countess. You have a great deal of Reason to rally our Extravagancies. The Beasts have that Simplicity and Decorum of Conduct, as would incline one to believe they were indew'd with Reason; and our Actions are frequently so capricious and indiscreet, that one would imagine we did not reason at all.

Prior. 'Tis evident however that the Operations of Beasts are attended with so much Certainty, only because an Almighty Providence has regulated the Circumstantials; whereas the Inequality that appears in the Conduct of Men, demonstrates their Enjoyment of a Reason which varies in its Limitations, and a Liberty which is as diversified in its Choice. But we wander from the Subject; let us return to the Inhabitants of the Air.

Chevalier. Are there any left who deserve a particular Attention?

Night
Birds.

Prior. I can think of none but the different Species of Night Birds. * All the other Tribes sing before the Sun rises, and perform the same Homage to him after he is set: But amidst this general Applause that is paid to the Light, the Birds of Darkeness are alone

* Explic. de l'ouvr. des 6 jours.

implacable

implacable against it : They avoid it as their Enemy, and never permit it to be the Spectator of their Actions ; and whilst it illuminates the Universe, they conceal themselves in Dens of the deepest Gloom. They wait with Impatience for the Return of Darknefs, that they may steal out of their Prisons in which the Day-light had inclosed them, and they then testify their Joy by Screams that are only capable of infusing Horror and Consternation into the Minds of all that hear them ; for each of these Birds has its particular Cry, according to their different Species, but there is none but what is doleful and alarming. Their Figure discovers something savage, hideous, fullen and gloomy ; and one would imagine he saw a settled Aversion against Man and all Animals painted in their Features. Almost all of them have a hooked Bill and sharp Tallons, out of which the Prey, when once seized, has no Possibility of Escape ; and they make use of Darknefs, and the Hours of Slumber, to surprise the other Birds who are taking their Repose, the most vigorous of whom with Difficulty elude them, but the Weakest are their infallible Prey. They likewise add Craft to Cruelty, and Artifice to Rage ; and after

ter they have kept Watch for the public Calamity, they retire before the rising of the Sun into Caves inaccessible to the Light. They generally prefer old Castles and ancient Ruins to any other Retreat, as if Rubbish and Desolation, which intimate the Neglect of the Master, or the Declension of Families, were capable of inspiring Sentiments of Alacrity in these fatal Birds.

'Tis impossible, in collecting all these Particulars, not to trace out the Image of those Dæmons of Malice and Darkness who are put to Flight by the Lustre of Truth ; who delight in every thing that clouds it ; who take Advantage of the Hours of Negligence and Sleep to devour the Souls they detain in Fetters of Iron, when they have once seized them ; who nourish themselves with their Calamities and Losses, and reside with the greatest Satisfaction in perverted and ruined Hearts. The holy Scripture authorizes this Parallel between Dæmons and Birds of the Night, and confirms us in the Belief that God, whose Wisdom is infinite, has replenished the Prospect and Order of Nature with profitable Instructions for Salvation. *Babylon*, * says the Scrip-

* Revelations, xviii. 2.

ture, is become the Habitation of Devils, and the Hold of every foul Spirit, and a Cage of every unclean and hateful Bird.

As the Birds of Darkness are Enemies to all the other Classes, they in their Turn are equally detested; and when the Owl, the Horn-Coot, the Osprey, and the like, are discovered anywhere, either when they are not carefully concealed, or because their Cries have detected them, there is a general Association against the dismal Bird. The small and great surround him with a loud Noise, though it is but seldom that he is attacked with as much Impunity as he is insulted. The Fowlers find their Account in this publick and declared Aversion when they spread their Nets for those who imprudently rush out at the real or imitated Cry of one of these Birds who is such an Enemy to the rest. For they build a Hut near a Wood, and cover it with the Branches of Trees, and then in several Parts of the Hut fix Lime-twigs, on which the Birds of all Kinds descend and perch the better to insult their Adversary, whose Cry revives their Animosity against him; and when they fall with the Lime-twigs that are not strongly fixed, they soil and embarrass their
Wings

Wings in the Bird-Lime, and lose both Liberty and Life in the Hands of the Fowlers, who are attentive to observe their Fall, and take Advantage of their Rashness.

Countess. This little Sport is very entertaining. You are no Stranger to it, *Chevalier*, I suppose.

Chevalier. I know very well that it is called the Decoy, and have frequently heard People speak of it ; but it is a Pleasure that has been only promised me.

Countess. We must give you the Enjoyment of it then.

Count. No later than To-morrow ; but can you rise before the Sun ?

Chevalier. I will take upon me to wake the whole House.

Count. Let us go then and order the necessary Preparations.

Chevalier. It shall be my Business to collect all the Cages in this House, as well as the *Prior's*, and the whole Village.

Count. We will furnish you with every Thing without obliging you to go any where else ; and I promise you that you shall always have more Cages than Birds.

TERRES-



TERRESTRIAL ANIMALS.



DIALOGUE XII.

The COUNT *and* COUNTESS.

The PRIOR *and the* CHEVALIER.

Countess.  RAY tell me, Sir,
whilst we are wait-
ing for our Compa-
ny, which sort of

Life is most agreeable to you, that of
an Academic, or that of a Fowler?

Chevalier. That of an Academic is
more instructive.

Countess. That's the Answer of a true
Norman. Speak to me without Re-
serve, if one should propose to you a
Lecture in Philosophy or a second De-
coy

coy in the Woods, how would you determine?

Chevalier. I would immediately prepare the Lime-twigs.

Countess. This is natural and undisguised : But however, instead of the Decoy, which cannot be frequently repeated because the Birds are shy of approaching the Place where the Net has been spread, and then you must build a new Hut, I say, instead of this, I promise to entertain you with the Diversion of Fishing as often as you please, which will be equally amusing to you. In the mean Time let us fall on the large Beasts, and turn the Conversation to terrestrial Animals ; but here are all our Company.

Gentlemen, if you are not dissatisfied at my regulating the Subjects of our former Conversations, permit me to continue in that Province. If I should let you choose, you would perhaps convey me into a Country of which I have no Map. After our Speculations on Insects and Birds, it would not be improper to proceed to terrestrial Animals, such as the Sheep, the Ox, the Lion, and the Elephant himself, if you please ; for my own Part, I shall confine myself to what is most common.

Countess

Count. Those Creatures, Madam, that are most common, deserve our strictest Attention. We need not go to *Asia* to discover Subjects for Admiration, we are surrounded with them at Home.

Countess. I desire, Gentlemen, that you would choose *Asia* and *Africa* for your selves, and if you please you may take in *America*, here certainly is enough to give you Satisfaction. If you take the common Animals, you deprive me of all my Quota, and your President will have nothing to say.

Prior. The Subject is copious, and will never be exhausted by our dividing it. Domestic Animals alone would furnish out twenty Conversations. *Chevalier*, be pleased to open the Thesis. Without any Study or Preparation you will be sensible of one of the finest Instances of the Deity's Bounty to Man, only by your answering a single Question. If one should search the Woods for a Sett of young Wolves, a Number of Fawns, and as many young Lions, would it not be possible to bring them up, to tame and distribute them into three Classes according to their Species, and nourish them in the Fields, like Sheep and Calves?

Chevalier.

Chevalier. It would be altogether impracticable. I am sensible we might rear them, and soften a little of their Fierceness; but these Animals have always a savage and traiterous Disposition. One could never keep them long, and much less lead them by Drove.--- We had two young Wolves brought up at our House, who seemed to be very sociable, but they soon took Care to undeceive us. The sly Animals were pleased one Morning to quarrel with a Dog, and thought fit to tear him to pieces; they likewise did us the Favour to kill three Kids, and then march'd off to the Woods.

Prior. You have imagined till now that this Union of a large Herd of Cows, a Flock of Sheep or Goats, under the Conduct of a single Shepherd, or the Wand of a Youth, was the Consequence of Man's Industry. But what Opinion do you entertain, when you consider this Matter with a little Attention?

Chevalier. I am very sensible that this Union is the Work of God alone, and one of the most amiable Presents he has condescended to make us.

Prior. Were it possible to tame Lions and Bears, yet we could never make them labour or carry Burdens; but
granting

granting even this to be practicable, would they submit to feed on the Herbage of the Field? Education never changes Nature; and if they were to be nourished according to their libertine and ravenous Inclinations, they would soon ruin their Master instead of assisting him in his Labours; on the contrary, the Generality of domestic Animals are but little expensive, and they work hard, they are furnished with great Strength, and employ it only in their Owner's Service; they immediately obey his first Command; What Gratitude do they expect for their Toil? Why truly a little Grass, and even the very driest or least valuable of all our Grains suffices them: The most delicious Food has Qualities to attract them, they rather turn from it with as much Aversion as if it were Poison. Has any Part of our Care produced in them Inclinations so abstemious and beneficial to us? Are they formed by our Industry? No certainly, and the *Chevalier* has very justly called them one of the Deity's most amiable Presents.

Countess. One must be either blind or ungrateful to deny this Truth; for these Creatures are not only tractable, but naturally loving; they come to tender us the Variety of their

G voluntary

voluntary Services, and never keep themselves at a Distance from us. Whereas the others, who are not pre-ordained to share our Labours, content themselves with doing us no Injury, unless they are in a manner compelled to it and retire to Woods; and Deserts out of Respect to Man, to whom they resign all the rest of the Earth.

Chevalier. Providence discovers itself in the benevolent Inclinations implanted in domestic Animals. But I would willingly know how we can reconcile the voracious Dispositions of wild Beasts with the Goodness of God: Does a Wolf, who darts on a Flock of Cattle, seem a proper Object to do Honour to his Providence?

Prior. He undoubtedly honours it in his Sphere, since he accomplishes the Views proposed in his Creation. Providence has formed some Animals to live with Man, and be serviceable to him; and has created others to people Deserts and Woods, to animate every Part of Nature, and chastise Mortals when they grow impious and abandoned. The same Providence appears admirable in the Complacency which it infuses into Animals who live for the Benefit and Support of Mankind; and is its Intention less conspicuous in the
Pre

Preservation of all those savage Beasts whom it nourishes in Rocks and Solitudes, without Folds or Pasture, without Magazines, or any other Assistance of Man's Contribution; or rather, in Opposition to all his Endeavours to destroy them: And who with all these Disadvantages are better accommodated with every Necessary, have more activity for the Chace, are stronger, better nourished, and endew'd with more Vivacity, are cloathed with a finer Skin, and have a compleater Turn of Shape, than the Generality of those who have Man for their Proveditor?

Countess. You see, *Chevalier*, that Providence shines and operates through all its Works, and rather merits our Adoration than Criticisms in Matters above our Comprehension. But I desire we may return to our domestic Animals, and talk of Things accommodated to my Capacity. Let his Lordship, for Instance, give us a Detail of his Horse's Perfections. The *Chevalier* may celebrate his Dog, whose Shape and Address he is so frequently boasting. I, for my Part, as a good Oeconomist, declare for the Cattle, and the *Prior* is at Liberty to distinguish all the rest.

Count. I am very well satisfied with ^{The} my Province. If Custom had not dig- ^{Horse,} nified

nified the Lion with the Title of King of Beasts, Reason, in my Judgment, would confer it on the Horse. The Lion is nothing less than the King of Animals; he is rather their Tyrant, since he is only capable of devouring or inspiring them with Terror: On the contrary, the Horse is never injurious to other Creatures either in their Persons or Properties: He discovers nothing that can expose him to the least Aversion; he possesses no bad Quality, and enjoys all those that are amiable: Of all Animals, he has the finest Turn of Shape, is the most noble in his Inclinations, the most liberal of his Services, and the most frugal in his Food. Cast your Eyes on all the rest: Do you see one whose Head discloses so much Beauty and Gracefulness? Can we discover any Eyes that Sparkle with more Fire? Can we behold a more stately Chest, a lovelier Body, a Main that floats in the Wind with greater Majesty, and Limbs that have a compleater Flexibility? Let him be managed by his Rider, or divest him of his Bridle and let him expatiate in full Liberty through the Fields, you will observe in all his Attitudes a noble Deportment, and an Air that makes an Impression even on those who are least acquainted with his Vertues.

He is still more engaging in his Inclinations, and indeed he can properly be said to have but one, and that is to render Service to his Master. Is he required to cultivate his Land or carry his Baggage? he is always prepared, and would sooner sink under the Weight of his Labours, than decline them. Is he to bear his Master himself? he seems sensible of the Honour, he studies how to please him, and at the least Signal varies his Pace, always ready to slacken, redouble, or precipitate it, when he is acquainted with his Rider's Will; neither the Length of a Journey, nor the Unevenness of the Way, nor Ditches, nor Rivers the most rapid, can discourage him, he springs through every Obstacle, and is a Bird whose Career nothink can check. Is he called to any other Service; is it incumbent on him to defend his Master, or bear him to the Attack of an Enemy? * he goeth out to meet the armed Men, he mocketh at Fear, and is not affrighted: The Sound of the Trumpet, and the Signal for Battle, awaken his Courage, and he retreats not at the Sight of the drawn Sword.

Countess. But this is a Penegyrick my Lord.

* Job. xxxix, 20.

Count. I had a thousand other Descriptions to make of the Boundings, and all the other majestick Airs of a Horse ; but since you rally me for the First Part of a Commendation that was unstudied, and couched in the most military Strain, you must excuse me from giving you the Second. Now *Chevalier*, produce your Dog, and give us a List of his Accomplishments.

The Dog. *Chevalier.* I should be glad to have him here ; he is more agreeable than any Description I can give of him : He is called *Mufti*, and is the King of Shocks. He has all that's pleasing in his Make ; has large Ears, graceful Whiskers, and a Ruff that is always white. He has no Deficiency in his Exterior, and with all this has been well broke, and performs his Exercise with a peculiar Grace. He can hunt, dance, leap and shew a hundred Dexterities : Among others, he brings to the Company all the Cards any of them have named.

Countess. How is it possible to train up Animals, destitute of Reason, to these Feats ?

Chevalier. They have at least a certain Degree of Memory. A Dog is first taught by repeated Trials to know something by a certain Mark, and then

to distinguish one Ace from another ; they frequently offer him Food on a Card he is unacquainted with, after which they send him to find it out from the rest, and he never Mistakes. The Habit of profitting by that Discovery and receiving Caresses, enables him, by Degrees, to grow acquainted with each particular Card, and he brings them with an Air of Gaiety, and without Confusion ; and, in Reality, 'tis no more surprizing to see a Dog distinguish one Card from thirty others, than it is to see him distinguish in the Street his Master's Door from the rest in the Neighbourhood. But *Musti* pleases me most with his Disposition, and the little Policies that are natural to him. When I take my Books, in order to go to the College, my poor Dog, who knows he is to be absent from me three Hours, puts on a melancholly and discontented Air : He plants himself before my Door, and waits for my Return : But if, instead of my Books, I take my Sword, and only mention the Word Abroad, he flies to impart his Happiness to all the Neighbourhood ; he runs up and down, and begins to bark in such a Manner, as makes it impossible for any one to forbear laughing. If I make it long before I go out,

he seems to suspect that I am considering how to dispose of him; he marches off by Way of Prevention, and waits for me at a considerable Distance from my Lodgings, full of Hopes to be one of the Party. If I tell him that must not be, he expostulates with me, and endeavours to prevail on me to revoke my Orders; He puts on an Air that deservedly pleads for Compassion, when he is positively told that he must return Home; but there is no Instance of Gratitude which he does not testify, when I say to him, Let us be gone. But the Affair is quite otherwise after I have been absent some Days; he imagines I return meerly on his Account, he commits a thousand Extravagancies, and a Couple of Hours are not sufficient for him to make me sensible of all that he has at Heart.

His Friendship does not end there, he seems to watch Night and Day to preserve me from being injured by any one. He is acquainted with all that passes, and gives me Intelligence of each Particular; but makes no Use of his Information, but what is conformable to my Orders; he reads his Behaviour in my Eyes, and when any one assaults me, a drawn Sword would not intimidate him. Some Months ago I be

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gan to practice Fencing, and the first Time I took my Lesson he fastened on my Master's Leg; and ever since they are upon such indifferent Terms with each other, that I am obliged to separate them.

Count. In reality, all the most ingenious Qualities a Dog is capable of acquiring, are not half so valuable as those lively and courageous Instances of Friendship he discovers for his Master; and it is evident, that God has con-signed the Dog to Man, to serve him as a Companion, and to aid and defend him. The Services we receive from Dogs are as various as their Species.

The Mastiff and the Bull-Dog guard our Houses in the Night, and reserve all their Malignity for the Season wherein People may form bad Designs against us. The Shepherds Dogs are equally qualified to assault the Wolves, and discipline the Flock. Among the Class of Sporting Dogs, the Terrier has very short Legs to enable him to creep under the Grass as well as Brakes and Bushes. The Greyhound, to facilitate his darting through the Air, has received a sharp Head and a slender Body: His Legs, that are so long and spare, stretch over a large Space of Ground; and in Swiftnefs, he even exceeds the Hare,

Hare, whose whole Safety consists in the Promptitude and Stratagems of her Flight. The Greyhound is the Contrast to the Terrier, as well in the Structure of his Body, as in his Functions: The latter has a weak Sight and a fine Nose, because he stands more in Need of a sure Scent than a piercing Eye, when he buries himself under Ground, or forces his Way through a thick Underwood: On the other Hand, the Greyhound, who is only useful in the Plain, has but an indifferent Nose; but then he never fails to see and distinguish his Prey at a Distance through all her Doublings. The Setting Dog stops and squats down when he sees the Game, to give his Master Notice of the Discovery. There are several Sorts of these Dogs, whose Names vary according to their Functions; but they are all equally zealous and faithful in accomplishing the Service prescribed to them. * The Master, who is seldom satisfied with those Friends that accompany him, and are irregular at the Sport, is however charmed with the Capacity and Understanding of all his Dogs. At the Conclusion of the Chace, and the short Satisfaction of the Carnage, which is not always granted them, they all

* Explic. litt. de l'ouvr. de six jours.

return to the Kennel and the String ; they then forget their Fierceness, make a gay Surrender of their Liberty, and, without murmuring, submit to the coarsest Food. 'Tis sufficient for them that they have regaled their Master with excellent Venison and a polite Amusement.

In a Word, among all these various Domesticks who are so submissive and devoted to our Interest, there are none, even down to Spaniels and the *Danish* Breed, but what render themselves agreeable by their Sprightliness, valuable by their Affiduity, and sometimes beneficial by a seasonable Intimation given to their Master in his Slumbers. Among Animals, I know but very few besides the Horse and Dog with whom one can maintain a friendly Intercourse ; and therefore the Proverb says, that a Man, a Horse, and a Dog, are never weary of each other's Company.

Countess. Mankind have a commodious Vehicle in a Horse, a faithful Guard in a Dog, and in both a sure and constant Amusement. But there are Things that are still more necessary for him to enjoy, such as Food and Raiment, and these he is supplied with by the Cattle. The Flesh of these Animals is so nourishing and so perfect,

fect, that we leave the most exquisite Delicacies to return to them, and are never fatiated with the Collations they afford us. Whilst we permit them to live, how do they employ their Time? It is evident that the Cow, the Goat, and the Sheep have been placed among us to increase our Riches: We feed them with a few Herbs, or allow them the Liberty to range in the Fields and supply themselves with those Productions that are least beneficial to us, and they return every Evening to repay this Obligation with a liberal Flow of Cream and Milk. The Night is no sooner passed, but they earn, by a second Payment, the Sustenance of the succeeding Day. The Cow alone furnishes the Poor with what suffices them next to Bread; and she crowns our Tables with Riches and the most delicious Variety. The Sheep, Content to be array'd only in Winter, resigns to us the Use of his Fleece in the Summer. In a Word, we derive from this Sett of Animals, as well as those who are less regarded, a hundred other conveniences which we cannot receive from those who fly from Man. The wild Beasts never approach us but with a View to rob us; the domestic Animals associate with us for no other Reason

Reason but to favour us with their Donations; and if the Value of their Presents is any way diminished, 'tis because we daily receive them, and think no more of them; they are depreciated by the Easiness of obtaining them. But, in Reality, this is a Circumstance which enhances their Merit. A Liberality that knows no Interruption, and is daily repeated, is ever worthy of new Returns of Gratitude; and the least we can do, when we receive a Benefit, is to vouchsafe an Acknowledgement.

These Animals are perpetually before our Eyes, and I daily discover some new Trace of a wise Ordination and a benevolent Providence. When I consider a Dam, I behold a Tenderness in her for her Young that reaches even to Excess. The Young has no Knowledge of any Thing, and is in a perfect State of Incapacity; but the Fondness of the Mother, supplies every Deficiency, and the Young has all its Necessities relieved. If I cast my Eye on this Young, it is a new Object of Admiration through all the Variety of its Progress: Before it is capable of seeing it can find the Teat, and though it be ignorant of the Necessity of pressing it, the Creature very dexterously employs its two Fore-paws alternately, and, by this

this Means, presses out the Nourishment. If the Parent and her Offspring are separated for any Time, they seek for one another with equal Impatience; and when they are near enough to be heard, they give mutual Notice by Cries that are intelligible to them: The Mother can distinguish the Bleating of her Young amidst a thousand Lambs; and this, amidst the Cries of a thousand Mothers, knows the Voice of the Parent that answers her. The Shepherd himself is deceived, but the Dam and her Young are never mistaken, and the mutual Information they give of their Arrival, are soon succeeded by a grateful Re-union.

When the Young becomes strong and capable of providing for himself, it is but reasonable that the Parent should be discharged from that Care; she accordingly drives him away, and treats him with Severity if he persists in following her; and the Tenderness of the one, continues no longer than the Necessities of the other; the Young, deprived of his Milk, is obliged to habituate himself to a less delicate Food; he learns to nibble the Grass, and to ruminate in the Night what he has cropped and reserved in the Day. By Degrees he distinguishes the Seasons

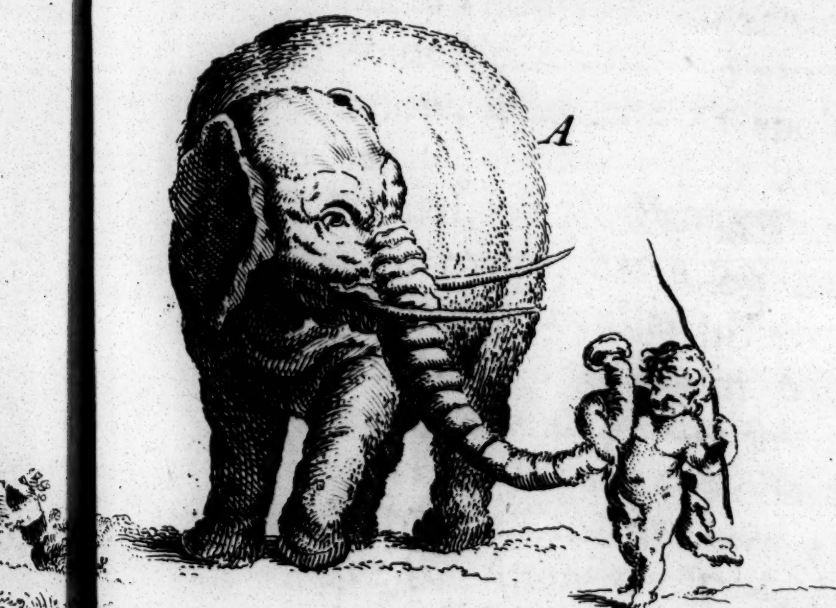
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A. Motte Sculp^t.

A. A tame Elephant. B. A Camel load



load A Camel lying down to be unloaded.



In the long Days of Summer he rests and ruminates, because he may do both without Hazard; but in the Winter, when the Days are short, he has no Time to lose; he eats with as much Dispatch as possible, and compleats the Digestion by rechewing the Food at his Leisure in the Night.

One might make a thousand Observations more on domestic Animals, but I am curious to know, what the *Prior* has reserved for us.

Prior. The Animal, whose Panegyrick I am going to make, has a Set of Qualities that are very peculiar. He is not used in all Places, but his Services are very extensive and profitable to Mankind; the whole World cannot produce a more laborious Creature, and at the same Time one more constant, abstemious and patient. You imagine, perhaps, that I am speaking of the Elephant, who, if People are so inclin'd, The Elephant and Camel. may be taught to obey a Child, and who bears on his Back Towers, fill'd with Warriors, without being intimidated at the Havock of the Battle; or you may think I mean the Camel, who is serviceable in long Journies, is able to carry a thousand Pound Weight, crosses Deserts without drinking, and soon as he arrives at the Inn, obligingly

ly bends his Knees and lowers himself to the Earth in order to facilitate the Discharge of his Burden : These Creatures have their Merit, but the Animal who is to be the Subject of my Discourse, is abundantly more useful and more generally employ'd.

Chevalier. May we know his Name.

Prior. Since I must declare it, it is the Afs.

Chevalier. Bless me, Sir, what a Choice have you made !

The Cat.

Countess. Had you no Animal to introduce but this? Why did you not take the Cat, who is so very serviceable? She is diverting in her Play : You would have a hundred Things to say, and a Number of Applications to make with Respect to her hypocritical Mien, her Paw so soft and yet armed with Tallons, her Craft, her Stratagems, and perpetually winding March : There would be Matter enough to exercise your Stile.

Prior. All the World gives up the Afs, but I intend to take him under my Protection. This Animal, considered in a particular Light, gives me a great deal of Pleasure ; and I hope to make it evident, that far from needing Candour or any Apology, he may be the Subject of a reasonable Panegyrick

I confess the Afs is not Master of ve-^{The Afs.}
 ry shining Qualities; but then he en-
 joys those that are very solid. If we
 resort to other Animals for distinguished
 Services, this at least furnishes us with
 such as are most necessary. His Voice
 is not altogether Melodious, nor his
 Air Majestic, nor his Manners very live-
 ly; but then a fine Voice has very
 little Merit with People of Solidity.
 With him, the Want of a noble Air
 has its Compensation in a mild and mo-
 dest Countenance; and instead of the
 boisterous and irregular Qualities of the
 Horse, which are frequently more in-
 commodious than agreeable, the Beha-
 viour of the Afs is intirely simple and
 unaffected; no supercilious and self-
 sufficient Air. He marches with a ve-
 ry uniform Pace, and though he is
 not extraordinary Swift, he pursues his
 Journey for a long Time, and without
 Intermiffion. He finishes his Work in
 Silence, and serves you with a steady
 Perseverance; and, which is a consider-
 able Accomplishment in a Domestic,
 he discovers no Ostentation in his Pro-
 ceedings. His Meats require no Pre-
 paration, for he is perfectly well con-
 tented with the first Thistle that falls
 in his Way; he does not pretend that
 any thing is due to him, and he never
 H appears

appears squeamish or dissatisfied; he thankfully accepts whatever is offered him; he has an elegant Relish for the best Things, and very civilly contents himself with the most indifferent. If he happens to be forgotten, or is fastened a little too far from his Fodder, he intreats his Master in the most pathetic Language he can utter, to be so good as to supply his Necessities. 'Tis very just that he should live, and he employs all his Rhetorick with that View. When he has finished his Harangue, he patiently waits the Arrival of a little Bran, or a few withered Leaves; and the Moment he has dispatched his hasty Meal, he returns to his Business, and marches on without a Murmur or Reply. These are certainly very valuable Accomplishments. Let us now see how he is employ'd.

His Occupations have a Tinge of the Meanness of those who set him to work, but the Judgments that are form'd both of the Ass and his Master, are equally partial. The Employments of a Judge, a Man of Business, and an Officer of the Revenue, have an important Air; their Habit imposes on the Spectators. On the contrary, the Labour of the Peasant has a mean and contemptible Appearance, because his Dress is poor

and his Condition despised. But we really make a false Estimate of these Particulars. 'Tis the Labour of the Peasant that is most valuable, and that which alone is necessary. Of what Importance is it to us when a Manager of the Revenue glitters from Head to Foot with Gold? We have no Advantage by his Labours. I confess that Judges and Advocates are in some Measure Necessary, but they are made so by our Follies and Misbehaviour; for they would no longer be wanted, could we conduct ourselves in a rational Manner: But on the other Hand, we could on no Account and in no Season or Condition of Life be without the Peasant and the Artisan. These People may be consider'd as the Soul and Sinews of the Community, and the Support of our Life. 'Tis from them that we are constantly deriving some Accommodation for our Wants. Our Houses, our Habits, our Furniture, and our Subsistence, rise out of their Labours. Now what would become of your Vinedressers, Gardeners, Masons, and the Generality of Country People; that is to say, two thirds of all Mankind, if they were destitute of other Men or Horses to convey the Commodities and Materials they employ. The Ass is perpetually

tually at their Service : He carries Fruits, Herbs, Coals, Wood, Bricks, Tiles, Plaister, Lime, Straw and Dung. The most abject Offices are his ordinary Lot, and 'tis a singular Advantage to this Multitude of Workmen, as well as ourselves, to find a gentle, strong and indefatigable Animal ; who, without either Expence or Pride, replenishes our Cities and Villages with all Sorts of Commodities. A short Comparison will compleat the Illustration of the Usefulness of his Services, and in some Measure, raise them out of their Obscurity.

The Horse very much resembles those Nations who are fond of Glitter and Hurry ; who are perpetually singing and dancing, and extremely Studious to set off their Exteriors, and mix Gaiety with all their Actions : They are admirable in some distinguished and decisive Occasions, but their Fire frequently degenerates into Romantic Enthusiasm : They fall into wild Transports ; they exhaust themselves, and loose the most favourable Conjunction for want of Management and Moderation.

The Ass, on the Contrary, resembles those People who are naturally heavy and pacifick, whose Understanding and Capacity are limited to Husbandry and Com

Commerce, and who proceed in the same Track without Discomposure, and compleat, with a serious and positive Air, whatever they have once undertaken.

Countess. Would not one be tempted to think the *Prior's* Observations true in every Particular?

Count. There is certainly something more than Rallery in what we have heard; but at the same time it is insupportable and contrary to all Decency, to make an Academic Oration in Honour of such an Animal: 'Tis degrading us who are the Audience; and if I am but seconded, it will be declared by the Majority of Voices, that the *Prior* has not furnished his Contingent, and must therefore be obliged to make us Amends for his Deficiency.

Chevalier. The *Prior* is in a fair Way of making another Oration: I don't Sentance him to begin again, but I confess I heartily desire it.

Countess. And, for my Part, I join my Authority as President to the Opinion of the Company, and declare that the *Prior* ought to furnish us with a more popular Encomium; and if the Gentleman should not think it proper to chuse his Subject among the domestic

H 3 Animals,

Animals, let him have Recourse to those that are Savage.

Prior. Those who make Laws are at Liberty to interpret them: May I be permitted to take some foreign Animal?

Countess. You may command the four Parts of the World: But pray favour me a Moment: Can you give us a Description of that Animal who is such an excellent Architect? I must beg you to assist my Memory, for I cannot recollect his Name.

The Field
Mouse.

Prior. I don't know any Animal who builds a more commodious Habitation under Ground than the Field Mouse, who scoops out several Subterranean Cells that have a free Communication with one another; in some of these the Creature stores his Provisions, which consist of Fruits according to the Season, but especially Nuts and Ears of Corn, which keep longer than any other Article of his Food, and are piled in Heaps. There are other Cavities where the Family are disposed on little Beds of Wooll and Flew. At the Extremity of the Lodge is another Place that furnishes all the rest with Accommodations in a very elegant Manner.

Countess. It is good to know these Particulars; but this is not the Animal I was speaking of.

Prior

Of TERRESTRIAL ANIMALS. 103

Prior. Perhaps your Ladyship means ^{The Porcupine.} the Porcupine or Hedgehog, who have also their Magazines. There is a perfect Similitude between these two Species. The Animal is intirely covered with large Prickles that are half white and half black: When he is attacked, he draws in his Head and Paws, rounds himself into a Ball, and erects his pointed Quills in such a Manner, that Dogs and other Animals are obliged to leave him. Those who persist in the Assault are great Sufferers, because the Darts of the Porcupine sheath themselves in the Flesh of his Enemy, and are continually penetrating deeper, which proceeds from their Structure that contorts itself into a spiral Line like a Screw; so that all the Motions of the wounded Animal, only contribute to insinuate the Darts farther instead of drawing them out. Just in the same Manner as we, when we were Children, sometimes surpris'd our Friends, by thrusting an Ear of Corn with the Beard downwards between their Coat and Wastecoa't, assuring them, that at the End of their Walk they would find the Ear mounted up to their Cravat; and which succeeded accordingly, because all the little Points with which the Ear is planted, being turned towards the

H 4 Ground,

Ground, hinder the Descent of the Grain, and at the same Time, all the Motions communicated to it, force it into a contrary Direction, and always cause it to ascend.

The Hedgehog makes another Use of his commodious Darts, for he rolls himself over Apples, Grapes and all other Fruits that he can find under the Trees, and carries them off on his sharp Quills in the best Manner he can. He eats what takes up most Room in his Cell, or is apt soonest to decay, and endeavours to have a Reserve of Nuts for the latter Season; but passes the Severity of the Winter in Sleep.

Countess. This Animal has likewise its Merit; but I am thinking of another that my Merchant of *St. Malo* entertained us so agreeably with the other Day.

Prior. Her Ladyship means the Beaver.

Countess. The very same.

Prior. But the Description of that Creature, Madam, will be infinitely more agreeable from you than me.

Countess. Very well indeed. What sort of Conscience, Sir, do you act by? You first contract a Debt, and then discharge it.

Prior

Prior. Compliance, I find, is absolutely necessary. To the Point then. We may consider in the Beaver, the Use that is made of his Skin, and the Dexterity with which he builds his Habitation.

This * Creature is about four Foot ^{The} in length, and twelve or fifteen Inches ^{Beaver.} thick. His Skin, in the Northern Regions, is generally black, but it brightens into a reddish Tincture in the temperate Climates. He is covered with two Sorts of Hair, one long and the other a soft Down ; the latter, which is an Inch in Length, is extremely fine and compact, and accommodates the Animal with a necessary Warmth : The long Hair preserves the Down from Dirt and Humidity.

The Beaver, whether Male or Female, has four Bags, under his Intestines, impregnated with a resinous and liquid Substance, which, when it is ejected, settles into a thick Consistence. We shall presently see to what Purpose the Animal employs it. Physicians call it *Castoreum*, and prescribe it as an excellent Remedy against Poisons,

* Memoir de l'Academ. des Scienc. 1704. Lettre de Mr. Sarrazin Medicin du Roi envoyé au Canada. Voyage du Baron de la Hontan. Memoires pour l'histoire des Animaux, de l'Imprimerie royale.

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Vapours, and other Indispositions ; but when it grows old, it blackens and degenerates into a dangerous Poison.

They strip the long Hair from the Beaver's Skin, and manufacture the Down into Socks, Stockings, Caps and even Stuffs ; but these have been found liable to harden like Felt, and are therefore disused in several Places, so that at present the Beaver is used for little else than Hats or Furs. There is one Circumstance which you may be apt to think incredible, though the Fact is certain ; what I mean is this, the Beaver's Skins are most valuable when the wild Natives of the Country have lain upon them a considerable Time, for by this Means the long Hair falls off, and the Down becomes compact and moist by Transpiration, and consequently fitted to be manufactured. But I perceive the *Chevalier* will grow impatient ; I don't shew him the Beaver's Dwelling.

Chevalier. Will you begin, Sir, as you did with Bees, and inform me what Implements this Creature is furnished with for Building.

Prior. He has three, his Teeth, his Paws, and his Tail : His Teeth are strong, and deeply rivited into his Jaw with a long and crooked Root : With

these he cuts as well the Wood with which he builds, as that which furnishes him with his Food. His Fore-feet resemble those of such Animals as hold what they eat in their Paws, as Apes for Instance, and Rats and Squirrels; with these Feet he digs, softens and works the Clay which is extreemly serviceable to him. His Hind-feet are accommodated with Membranes or large Skins extending between his Toes like those of Ducks, and all other Water Fowl: This makes it evident, that the Author of Nature intended the Creature should be amphibious. His Tail is long, a little flat, intirely covered with Scales, supplied with Muscles, and perpetually lubricated with Oil or Fat: This Animal, who is an Architect from his Nativity, uses his Tail instead of a Hod for the Conveyance of his Clay or Mortar, and a Trowel to spread and form it into an Incrustation: The Scales prevent these Materials from penetrating the Tail with their Coldness and Humidity. But the Scales, as well as the Tail, would be injured by the Air and Water, were it not for the Prevention of an Oil, which he distributes all over them with his Snout; and the Bags I have already mentioned, are undoubtedly the Magazines of this Fluid.

The

The Beavers inhabit the same Mansion in great Numbers, unless violent Heats or Inundations, the Pursuits of Hunters, Scarcity of Provisions, or the extraordinary Increase of their Offspring, oblige them to dislodge. In order to raise themselves a convenient Abode, they chuse a Situation that abounds with Sustenance, and is washed by a Rivulet, and where they may form a convenient Reservoir of Water for their Bagnio. They begin with building a Mole or Causey in which the Water may rise to a Level with the first Story of their Habitation.

Chevalier. The first Story ! Have they a first and a second like us ?

Prior. Exactly the same. But let us first examine the Causey which forms their watering Place, and serves to raise the Water to a sufficient Heighth. This Causey at the Foundation, may contain ten or a dozen Feet in Thickness : It descends in a Slope on the Side next the Water, which in Proportion to its Elevation, gravitates upon the Work, and presses it with a strong Tendency towards the Earth. The opposite Side is raised perpendicular like our Walls and the Slope, which at its Basis is twelve Feet thick, diminishes towards the Top, whose Dimensions do not ex-

ceed

ceed two Feet in Breadth: The Materials of this Work are Wood and Clay. The Beavers, with an admirable Facility, cut the Pieces of Wood, some as thick as ones Arm, others as large as ones Thigh, and from two, to four, five, or six Feet in Length, and sometimes more, in Proportion to the Ascent of the Slope. One Extremity of these they drive very near each other into the Earth, and take Care to interlace them with other Stakes that are more slender and supple. But as the Water, without some other Prevention, would glide through the Cavities, and leave the Reservoir dry, they have Recourse to a Clay which they perfectly know how to procure, and with which they close up all the Interstices both within and without, and this intirely prevents all Evacuation. They continue to raise the Dike proportionable to the Water's Elevation and Plenty. They are likewise very sensible that their Materials are not so easily transported by Land as Water, and therefore they take the Opportunity of its Increase, to swim with Mortar placed on their Tail, and Stakes of Wood between their Teeth to every Place where they have Occasion for these Materials. If the Violence of the Water, or the Footsteps of

of the Hunters who pass over their Work, damages it in any Degree, they immediately repair the Fracture, visit all the Edifice, and with indefatigable Application refit and adjust whatever happens to be disconcerted. But when they are too frequently persecuted by the Hunters, they only Work in the Night, or else abandon their Habitation.

When the Causey or Dike is completed, they begin to form their Cells, which are round or oval Apartments divided into three Partitions, which they raise one above another. The first is sunk below the Level of the Dike, and generally full of Water: the other two are built upon it. They raise this Structure in a very solid Manner on the Edge of their Causey, and always in Stories, that, in Case the Water should ascend, they may dwell in an higher Situation. If they find any little Island near the Causey, they fix their Dwelling there, which is then more solid, and they are less incommoded with the Water in which they are capable of continuing but a short Time. But if they are not favoured with this Advantage, they drive Stakes into the Earth with their Teeth to fortify the Building against the Winds and Water. At the Bottom they strike out two
Opening

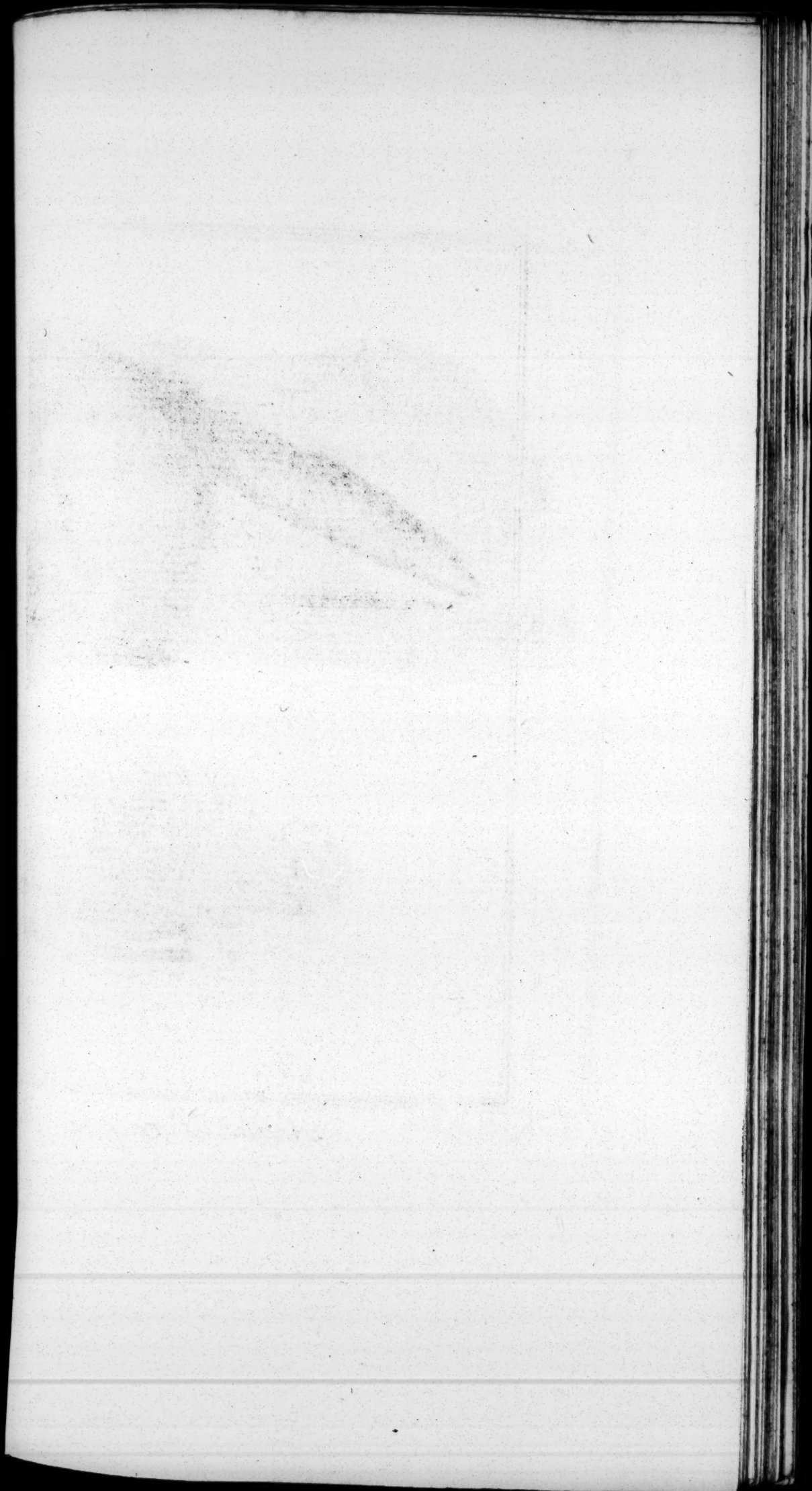
Of TERRESTRIAL ANIMALS. III

Openings to the Stream, one conducts them to the Place where they Bathe and which they always keep very decent, the other is a Passage to that Quarter where they carry out every Thing that would soil or rot the upper Apartments. There is a third Aperture much higher, calculated to prevent their being shut up when the Ice has closed up the Openings into the lower Lodgements. They sometimes build their House intirely on the dry Land, and sink Ditches five or six Feet deep, in order to descend to the Water. They employ the same Materials and Industry in the Structure of their Dwelling as they use for the Causey. The Walls of the Building are perpendicular, and two Feet thick. As their Teeth are more serviceable than Saws, they cut off all the Projections of the Wood that shoot out beyond the Perpendicular of the Wall; after which they work up a Mixture of Clay and dry Grass into a kind of Mortar, with which, by the Aid of their Tails, they rough cast the Out and Insides of the Work.

The Edifice is vaulted within like the Handle of a Basket, and generally lies in an oval Figure. The Dimensions are proportioned to the Number of the intended Inhabitants. Twelve Feet
in

in Length and ten in Breadth are sufficient for eight or ten Beavers. If the Number increases, they enlarge the Place accordingly. It has been asserted for a Truth, that there have been found above four Hundred of these Creatures in different Lodgments communicating with one another. But these populous Societies are very rare, because they are too unmanageable and tumultuous, and the Beavers are generally better acquainted with their own Interests. They associate to the Number of ten or a dozen, and sometimes a few more: They are a Sett of amicable and sagacious Inhabitants, in whose mutual Society they may propose to pass the Winter together in a very agreeable Manner. They are gifted with a natural Arithmetic, which enables them to proportion the Place and Provisions to the Necessities of the Company: And as it is customary for every Individual to continue in the constant Possession of his own Cell, they never charge themselves with unnecessary Expence for any accidental Guests.

There are some Beavers, called Terriers, who make their Abode in Caverns dug in a rising Ground, either on the Shore, or at some Distance from the Water, to which they scoop out Subterranean





A. The Porcupine. B.



B



Hedgehog. C. The Beaver.

A. Motte sculp.



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terranean Trenches from their Cavern, which descend from ten to an hundred Feet in Depth. These Trenches furnish them with Retreats situated at unequal Heights, and wherein they enjoy a Shelter from the Water when it ascends. Their Beds are made of Chips, which serve them instead of a Quilt, and of Grass, which accommodates them in the Nature of a Feather-Bed.

All these Works, especially in the cold Regions, are compleated in *August* or *September*, after which Period they furnish themselves with Provisions. During the Summer Season, they regale themselves with all the Fruits and Plants the Country produces. In the Winter, they eat the Wood of the Ash, the Plane and other Trees, which they steep in Water, in Quantities proportionable to their necessary Consumption; they are supplied with a double Stomach to facilitate the Digestion of such solid Food, at two Operations. They cut Twigs from three to six Feet in Length; the large ones are conveyed by several Beavers to the Magazine, and the smaller by a single Animal; but they take different Ways. Each Individual has his Walk assigned him, to prevent the Labourers from being interrupted by their mutual Occursions.

The Dimensions of their Store-House are regulated in proportion to the Number of the Inhabitants; and it has been observed, that the Provision of Wood for ten Beavers comprehended thirty Feet in a square Surface, and was ten in Thickness. These Parcels of Wood are not piled up in one continued Heap, but laid cross over one another, with Interstices between them, that they may the better draw out what Quantity they want, and always take the Parcel at the Bottom which lies in the Water. The Hunters, who are sensible that these Creatures love green Wood better than that which is old, place a Parcel of the former about their Lodge, and then have several Devices to ensnare them. When the Winter grows severe, they sometimes break the Ice, and when the Beavers come to the Opening to take in fresh Air, they kill them with Hatchets; or else they make a large Aperture in the Ice, and cover it with a very strong Net, and then overturn the Lodge; upon which the Beavers, who think to escape in their usual Way, by flying to the Water, and emerging at the Hole in the Ice, fall into the Snare and are taken.

Chevalier. 'Tis pity to overturn the Tenement of these poor Beasts; on

can no where else discover such remarkable Industry.

Count. Travellers ascribe pretty near ^{The Civet} the same Inclinations and Labours to ^{Cat.} the Civet Cat, who is an Animal peculiar to *America*, and larger than our House Cats. This Creature in every Particular is a Beaver in Miniature, and therefore it would be needless to make him the Subject of any further Discourse.

Countess. *Chevalier*, do you take Notice of what they are doing on the Bank of the Mote? 'Tis an Affair wherein you have some Concern.

Chevalier. Where are those Persons going with their Poles and Nets? 'Tis certainly a Party of Fishing, which her Ladyship has an Inclination to entertain me with: I hope these Gentlemen will favour us with their Company.

Count. We are inseparable from the *Chevalier*, and esteem his Pleasures our own.

Prior. You know, my dear *Chevalier*, that I am a Fisher of Men: I hope your Fishing will be agreeable to you, but you must permit me to have some Regard for mine.



F I S H E S.



DIALOGUE XIII.

The COUNT the COUNTESS.

The PRIOR and the CHEVALIER

Countess.  *CHEVALIER,* we are come to break in upon your agreeable Meditations.

observed you lying above an Hour on the Turf that borders this Bason: May one know what it was that engaged so much of your Attention?

Chevalier. I have been making Visit to the Perch and Carp, which reserved out of your Yesterday's Fishing, and restored to Liberty in this Water: I threw some Bread to them which they devoured with great Eagerness: I have observed all their Motions which amused me with several Thoughts on the Nature of Fishes, and I had a Number of Questions to propose

these Gentlemen. In the first Place, I am unable to comprehend why the Water, that stifles all other Animals, should be no way injurious to these. I should likewise be glad to know what particular Food they have to subsist on; and how they are able, without Feet, Arms, Talons, Trunk, or Sting, to advance and seize their Prey.

Countess. If your Meditations, *Chevalier*, always produce such reasonable Questions, indulge them frequently, and you will make great Discoveries. Every Particular you have mentioned has employed my Thoughts, and I should be glad to hear the Answers these Gentlemen are preparing.

Prior. I can give your Ladyship some Satisfaction with Respect to the Element and Food of Fishes, but it requires a more delicate Philosophy than mine to account for their progressive Motions and Manner of Swimming: This must be his Lordship's Province.

I am going to resume the Contemplations of our amiable Philosopher. I place myself on the Edge of the great Basin, and fancy myself the *Chevalier* engaged in the following Train of Thought. I have constantly beheld all Nature replenished with Inhabitants. The Air is peopled with a hundred

Classes of Animals; others expatiate in the Fields, and creep on the Surface of the Earth. There are Families in the deep Recesses of Woods, the Hearts of Leaves, and under the Bark of Trees. The very Bowels of the Earth are hollowed and inhabited: But all these Creatures, so different from each other in their Nature and Manner of Life, have one Circumstance in common among them, they breath the fluid Air. But we are now considering another Element, in which they all die when they are plung'd in it. Is it then impossible to live in the Water? Quite the contrary, I there discover a Variety of Tribes; and as the Animals that cover the Earth die in the Water, so observe that the Inhabitants of the Waves perish in the Air, and are incapable of living out of the Element to which they are consigned: But, notwithstanding all this, I find it difficult to comprehend in what Manner the Blood, for with such they are furnished is capable of Circulation, and why it is not coagulated and condensed by the extraordinary Chilness of the Water. The terrestrial Animals are accommodated either with Feathers or a delicate Down, or are cloathed with good Fur, garnished with Hair, to defend them from

the Impressions of the Air, which is sometimes excessively cold ; but I am not able to discover the least Similitude in any of these Circumstances among Fish. What are they supplied with to enable them to resist an Element much colder than the Air? Let us recollect what we have sometimes observed either in handling or opening a Fish : The first Thing that offers itself to the Touch is a certain Glew that moistens all the Surface of the Animal's Body. In the next place, I observe a Covering composed of strong Scales ; and before I come to the Flesh of the Creature, I discover a kind of Lard or oily Flesh, which extends from one Extremity to the other, and encompasses the whole. I can neither comprehend how these Scales receive their Formation, their Growth, and Supplies, nor what is the Origin and Reservoir of this Oil : But these Scales, by their Solidity, and this Oil, by its Antipathy to the Water, preserve the Fish both with Warmth and Life ; he could not be accommodated with a Robe that would be at once more light and impenetrable ; so that where-ever I direct my View, I perceive a Wisdom perpetually fertile in new Designs ; perfectly acquainted with every Circumstance of its Work,

and never contradicted or embarrassed by the Disobedience of the Materials it employs.

Chevalier. I begin to find that I meditate very well. I am pleased to hear myself, and think it adviseable to continue.

Prior. Let us do so. But instead of the Bason's Edge, let us imagine we had the Shore of the Ocean in Prospect. Let us take our Station on an Eminence, from whence our View may be extended in full Liberty over this immense Bason, which was hollowed by the Hand of the Almighty. The Salt Waters which it contains, seem to have a manifest Sterility, or if they give Life to some particular Animals, their Flesh will be improper for our Nourishment. But I find myself mistaken, and God has not constituted Man the Lord of the Fishes of the Sea, as well as of other Animals in vain; and I even observe a Multitude of Fisher-boats sailing from all the neighbouring Shores to collect the Bounties of the Sea, and which furnish us with a Nourishment equally diversified and delicate. Here my Nourishment redoubles. Navigators have made several Attempts to render the Water of the Sea serviceable to them in long Voyages, and according to the Account

Accounts, have succeeded to a certain Degree, but this Water could never be made fit to be drank. The Sea washes from the Lands which it laves, a Vitriol and Bitumen, which, being like itself, in a perpetual Agitation, disperse and insinuate themselves so intimately to the smallest Particles of the Water, that neither Filtrations, nor the Power of the Still, nor any other Methods, have been able to purify it from its Brackishness. And yet it is in this Water, whose Taste is so displeasing and insupportable, that God nourishes and brings to Perfection the Flesh of those Fish, which the Voluptuous prefer to the most exquisite Fowls. These are Things which seem to be impossible, yet they are not to be contested. I am sensible at every Step I take, that God obliges me to believe certain Doctrines in Nature as well as Religion, of which he has not thought fit to impart to me an adequate Comprehension; and having judged it sufficient to disclose to me the Existence and Reality of the Wonders that are produced by his Power, he requires me to sacrifice my Reason to the Nature of his Works, and the Manner in which he effects them.

Let

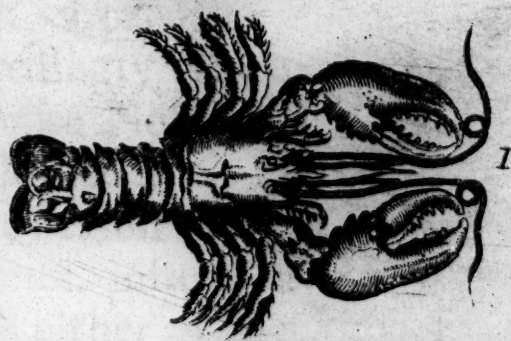
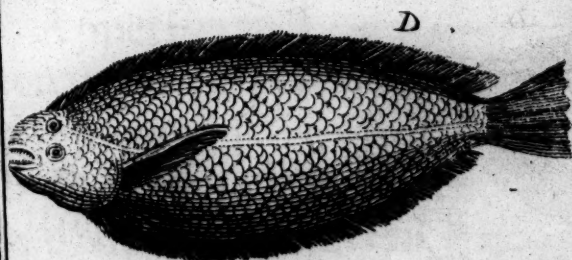
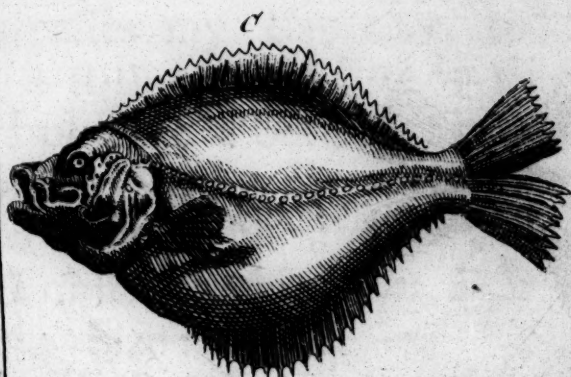
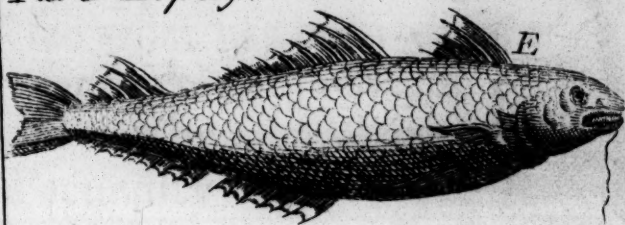
Let us continue to coast along the Shore, and approach one of these Fishers, to see what has been caught. In an Element which produces nothing, one would not imagine either the Number or Fecundity of the Inhabitants to be very considerable. All that I behold surpasses my Capacity, and my Reason is still contradicted by Experience. I observe a Sett of Fishermen, who, contrary to my Expectation, have taken an infinite Number of Muscles, Crabs, Lobsters, and other Fish of a monstrous Size: I discover Piles of Oysters, whose Whiteness and Fat excite my Appetite. I perceive other Fishermen who empty their Nets, and obligingly present us with a Profusion of Turbots, Flounders, Dabs, Burts, Plaice, and all the Species of Flat Fish, shaped like Lozenges, and whose Flesh is so exceedingly esteemed. In another View, I take Notice of a whole Fleet of Ships loaded with Herrings, and this is now the Season for that Fishery. * At other Times, instead of Herrings, there are Shoals either of Mackerel or Whittings, who voluntarily present themselves on the Coasts, and with which whole Provinces are furnished by the Capture of a single Day. It should

Shell Fish.

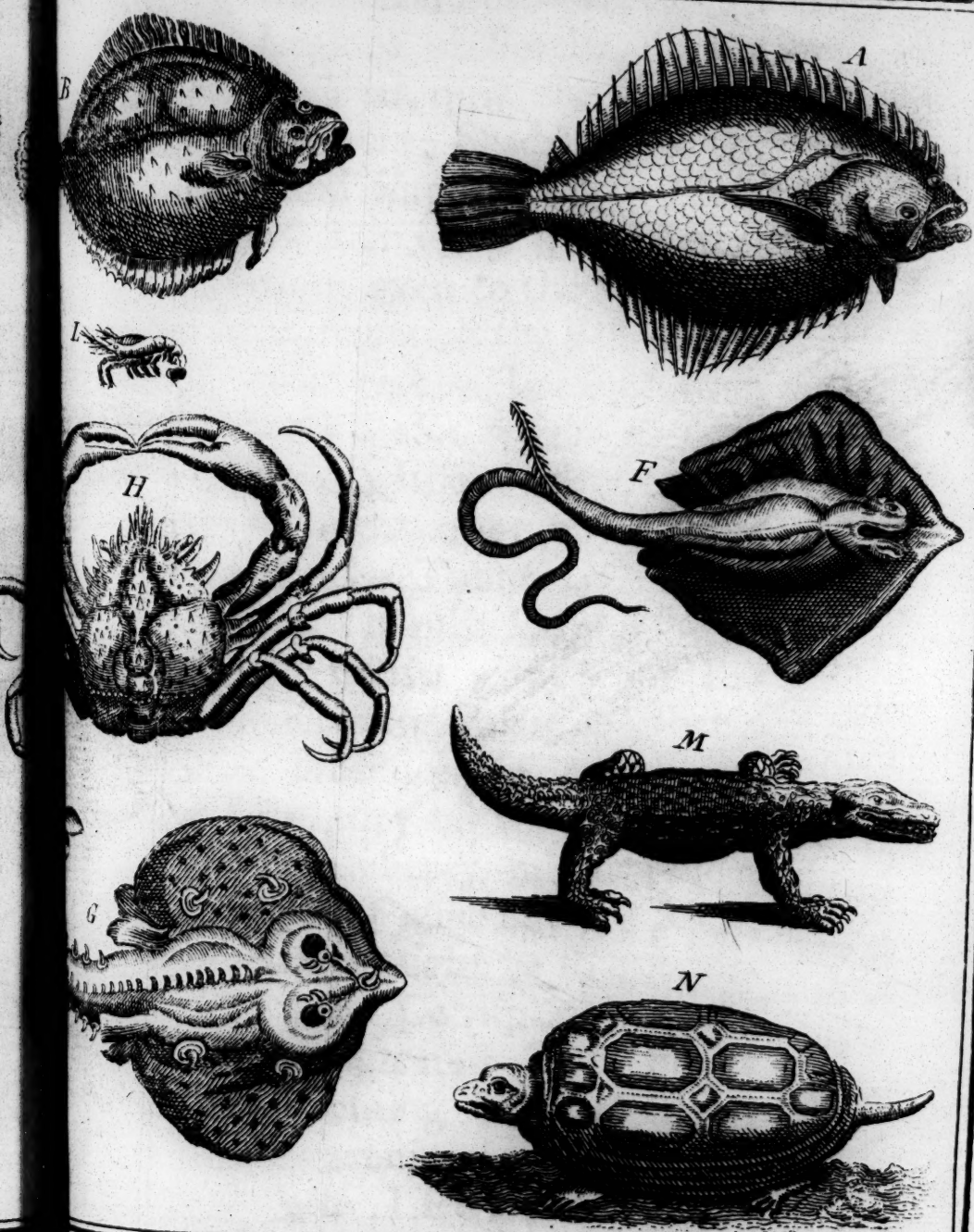
Flat Fish.

* Ruisch. Theatr. anim. Tom. i.





A. The Barble B. The Turbot
 C. A kind of Thornback
 D. of them H. The Crab I. The Lobster



The Flounder D. The Sole E. The Cod
 with a dangerous Sting G. Another kind
 The Shrimp M. The Crocodile N. The Tortoise

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seem as if the Sea was incapable of containing the Treasures with which it teems. Legions of Smelts, in the Smelts. Spring of the Year, quit the Sea and swim up the Rivers; Shads follow the Shads. same Track, and improve their Flesh to its due Perfection in the fresh Water; Salmon continue even to the Month of July and later, to enrich the Fishermen, sixty and even eighty Leagues from the Sea. Every Season regales us with new Pleasures; without interrupting the ordinary Presents they make us of * Lampreys, Smelts, Tunnees, Goldfish, Rockets, Soles, Thornbacks, and such a Variety of others that garnish our Tables and please every Palate. What a Delicacy and Profusion do we receive from the Liberality of this Element! But this very Delicacy might render them attainable by none but the Rich; or the Abundance might be so extraordinary, that the Corruption of the Whole, or the greatest Part, might prevent their coming to Perfection; both these Inconveniencies are remedied by a little Salt. I see all our Fishermen employed in barrelling up their Herrings after they have been salted. ^{Herrings.} In the High Seas already appear the Vessels that bring us from Newfound-

* Bellon. de aquatil.

land,

land, that is to say, from a Distance of near a thousand Leagues from hence, an incredible Number of Cod-fish preserved by this Precaution: In this Manner the Sea loads us with its Bounties; and at the same Time supplies us with Salt that facilitates their Communication, and secures their Conveyance: By which Means the Poor, who live at the remotest Distance from the Sea, are also made Partakers of its Favours at a small Expence. I have no Expressions that can rise to any Equality with my **Admiration and Gratitude**. In this **Prodigality of the Sea**, I likewise discover a Precaution that enhances the Value of its Gifts, and proves a new **Benefaction to us**. Those Fish who are wholesome and palatable, are extremely prolifick, but those whose Flesh is disagreeable and pernicious, and whose enormous Size renders them formidable to others, are commonly viviparous; that is to say, they bring their Young compleatly formed into the World, and have seldom more than one or two at most at a Birth: Of this Class are the Whale, the Dolphin, the Porpoise, and the Sea Calf. The same Wisdom which has so advantageously regulated the Bounds of their Fecundity, removes far
from

from our Shores those whom we have no Occasion for, and brings to our Nets all the Species that are most beneficial to us.

Whales, Porpoises and all the great Fish, whose Appearance would alarm and put to flight all those which nourish us, seek the High Seas for fear of being driven on the Coasts, where they would be destitute of a sufficient Body of Water to sustain them. An invisible Hand impels them to those Parts that are abandoned by the rest, and prepares for them a Nourishment hitherto unknown, amidst the Ice of the North, and the Seas that wash the Coasts of *Greenland*; or it drives them into those Parts to support the miserable Inhabitants, whom it would not totally neglect: These People eat the Flesh and drink the melted Fat, and likewise employ the Bones and Skin in building, as well as lining the Boats in which they fish.

All other Species, on the contrary, come in Shoals to our Coasts, some are always with us, others swim yearly to us in vast Multitudes; the Time of their Passage, and their particular Track, are very well known; and very singular Advantages are derived from that Knowledge. Let us form a Judgment of

Fish of
Passage.

of other Fish of Passage by Herrings and Cod. The Nation of Herrings seem to have their Capital between the Points of *Scotland*, *Norway* and *Denmark*. From that Situation the *Danish* Colonies take their Progress every Year, and traverse, at different Times, the Channel, and after they have passed by *Holland* and *Flanders*, visit our *Neustria*. But however, these are not a Troop of Banditti, who coast about at random: Their Tour is prescribed, and their March regulated: The whole Body of them begin their Departure at the same Time: None are permitted to straggle out of their proper Track; none among them desert or commit Depredations: They continue their Progress from Coast to Coast till the appointed Period: They are a numerous People, and the Voyage is long, and when the Body of the Army is passed, they are all gone, and none of the same Species make their Appearance till the next Year. Attempts have been made to discover what induces the Herrings to undertake such a Voyage, and inspires them with the Policy they observe. Our Fishermen, as well as those of *Holland*, have observed, that the Channel every Year teams with an innumerable Multitude

titude of Worms and little Fish on which the Herrings feed. They * are a kind of *Manna*, which these Creatures come punctually to gather up; and when they have entirely clear'd the Seas in the Northern Parts of *Europe* during the Summer and Autumn, they descend towards the South, where they are invited by a new Stock of Provisions; but if these fail, they then go to accommodate themselves elsewhere; their Passage is more expeditious, but the Fishery less valuable.

Our Seas are but little frequented by Cod-fish; their great Rendezvous is at the vast Bank before *Newfoundland*: There they keep their Festivals, and are so prodigiously numerous, that the Fishermen who assemble there from all Nations, are employed from Morning to Night in nothing but casting the Net, drawing up and embowelling the Cod, and fixing their Entrails on Hooks in order to catch others. † One Man sometimes catches three or four Hundred in a Day. When the Sustenance that allures them is exhausted in those Parts, they disperse and proclaim War against the Whitings, which they are extremely fond of: § These fly before

* Læuwenhoek Op. Phys. 42.

Comm.

§ Læuwenhoek, *ibid.*

† Savari. Dic.

them,

them, and we owe the frequent Returns of these Fish on our Coasts to the Chase given them by the Cod-fish.

The Wars
of Fishes.

Their
Food.

Their Ge-
neration.

Now I have mentioned their Wars, I recollect what has been told me of that which reigns through all the other Species: The Muscle lies in Ambush on a Bed of Sand, where she opens, and then suddenly shuts her Shells, when any little Crab who is insensible of the Danger, ventures to enter between them; the same is practised by the Oyfter with Regard to other Fish who are guilty of the same Imprudence. The Soal, as well as the Generality of flat Fish, conceal themselves in the Mud, whose Colour their Backs very much resemble, and are attentive in observing where the Females of the large Fish dig Holes for their Eggs, on which the Males afterwards deposite their Roes to make these Eggs prolifick: The Soal immediately springs from her Ambuscade, and solaces herself with this exquisite Food, which contributes to fatten her, and gives her an admirable Flavour. The small Soals, in their Turn, afford a Nourishment to the large Crabs; and as such Kinds of Shell-fish seldom forsake the Gravel where they search for the Eggs of Fish, there are scarce any Species of them but what are

are sustained by this Sort of Food, and one can hardly open any of them without finding one or two little Soals. You may judge of the other Species by this. All the Tribes of Animals that breed in the Water, from the largest to the least, are perpetually in Action, and at War; it is a constant Scene of Stratagems, Flights, Evasions and Violence; they mutually plunder and devour one another without Remorse or Moderation; in a Word, the Conduct of Fish resembles that of Mankind, and I am surprized that no one has been tempted to allow them the Faculty of Reason; but a more serious Thought occurs to me. If the Inhabitants of the Water are always upon the Watch to make mutual Depredations on their Eggs and Roes, and devour one another, this Element would in Time cease to be replenished, and indeed had long ago been entirely depopulated; as the smaller Fish are a Prey to the stronger, those must have been all destroyed, and these, in their Turn, would have perished for want of Sustenance; but nothing can be more frivolous than the Criticisms made by Man on the Works of God; he has provided for the Preservation of Fish, by giving Strength to some, and to others, Activity and Circumspection;

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and

Their Fecundity.

and by multiplying them to such an astonishing Degree, that their Fecundity exceeds their natural Impatience to devour one another; * and that which is destroyed is always much inferior to what remains to recruit the Species. As great as the Number of Cods may be that have been consumed by Man this Year, or devoured by other Fish, what remains of that Tribe is always more than sufficient to furnish us with the same Quantity a Year or two hence. And this is the Demonstration: When I went to view the Port of *Dieppe*, they brought us a very fine fresh Cod, but much inferior to those which are brought from the Great Bank. I was curious to count the Eggs she contained; took as many as weighed a Dram, and Three of us engaged to number them; we agreed pretty well in our Account, and then writ down the Total of the whole Dram; after which we weighed all the Mass of Eggs, and repeated eight times the Sum of one Dram every Ounce, which contains eight Drams, that the Whole amounted to
 † The Addition of all these Sums produced a Total of Nine millions three hundred and forty-four thousand Eggs.

* Explic. de l'ouvrage de six jours.
 hoek, Ep. Phys. 20.

† Leen

Countess. I don't pretend to compute after the *Prior*, and I have no Difficulty in believing what he says, as incredible as it may at first appear. A common Carp is far from having such a Number of Eggs as a large Cod; but for all that, the Quantity is so amazing, even at the first Glance, that it contributes very much to justify your Calculation. All that you have related astonishes me extremely, and gives me likewise an Inclination to meditate, or, in other Words, to reason. When we are curious to know what may be the End or Intention of this prodigious Fruitfulness, 'tis certainly not to stock the Rivers and Sea with as many Fishes as there are Eggs, for if it was, I am apt to think the Basen of the Sea would not be sufficient to contain them: But we see there is a double View in this Fertility; one to preserve the Species amidst all Accidents that may happen, and the other to accommodate the Fish with a plentiful and juicy Food.

Chevalier. At present, I see, in some measure, how Fishes are enabled to live in the Water, and preserve their Species. I there discover Shell-fish, Worms, Eggs, Roes, and small Fish, in such an extraordinary Abundance, that I am no longer in Pain for the Accommodations

The Intention of this Fecundity.

of the Table. The Inhabitants of the Water have a sure Allowance; but their Food conceals itself and flies from them; and I discover nothing in Fish besides a Head, a large immoveable Body, and a Tail. How are they able with so few Organs, to advance, swim, and launch on their Prey? There is likewise another Circumstance in which I find myself lost. Before I threw my last Carp into the Water, I took my Scissars and cut his Fins, upon which I imagined he would be incapable of swimming any more; and yet this Carp shot away, and darted up and down, but he was always turned either on one of his Sides, or with his Back downwards, whereas all the others swim on their Belly.

Countess. The poor *Chevalier* have no Sleep To-night, if these Difficulties be not cleared up.

Count. I shall let you know, my *Chevalier*, in what Manner I conceive these Operations to be practicable.

The Figure of a Fish.

The Tail.

Figure of all Kinds of Fish, as it naturally tapers a little at the Head, which enables them for traversing a Fluid. Tail, by the Assistance of its Muscles extremely flexible, it is furnished with great Strength and Agility, in order to the Right and Left, and as

covers itself into a streight Line, repels the Water behind it; after which, it immediately bends to the Right and Left; and by this alternate Impulse, advances the Head and all the rest of the Body, in an infinitely better Manner than that by which a progressive Motion is communicated to a Boat by an Oar placed at the Stern, and work'd about alternately to the Right and Left. The The Fins. Fins which are inserted under the Belly of the Fish, contribute likewise in some degree to repel the Water, and put the Body in Motion; they also cause it to stop when they are extended by the Fish, and cease to play to and fro; but their chief Function is to regulate the Motions of the Body, by poising it in an Equilibrium, so that if the Fish only moves the Fins on her right Side, and brings those on her left close to her Body, all the Motion is immediately determined to the Right: Just as a Boat with two Oars, when only one of them is employed, will always turn to the Side to which it is impelled against the Water by the other. Deprive the Fish of these Fins, the Back, which is heavier than the Belly, being no longer kept in a due Poise, will slant on one side, or be quite inverted; and this happens to dead Fish, who rise to the

Surface of the Water with their Fins uppermost.

Chevalier. I fancy, my Lord, that I comprehend a little how the Tail of a Fish, in a direct Position in the middle of the Water, is capable of striking on one Side and the other; this is sufficient to give the Body a progressive Motion: But this Tail, which has no Thickness, can neither impel the Water upwards or downwards; and therefore I cannot see how the Fish is able either to mount or descend.

Count. I expected that Question, and have an Answer prepared in this Paper. Do you know, Sir, what this is which I now shew you?

Chevalier. 'Tis the Bladder of a Carp. Who has not jumped upon it once in his Life?

The Bag
of Air.

Count. The Generality of Fishes have one like this, or something equivalent; we see it every Day, but give it a very equivocal Name; and indeed the Use of it is very different from what is commonly imagined. * This pretended Bladder is a Bag of Air which enables the Fish to rise and sink, in Proportion to its being dilated or contracted.

Nothing is easier to be comprehended, and a little Attention will make

* Borelli de motu Animal.

you Master of the Fact. In the first place, lay it down as a certain Principle, equally agreeable to good Sense and Experience, * that a Body swims on the Water, when it is not more weighty than that Quantity of the Fluid whose Place it possesses. If a Board whose square Surface contains two Feet, and its Thickness as many Inches, is equal in Gravity to a Body of Water of the same Dimensions, it swims on the Superficies; and if it be but half as heavy, no more than half its Thickness will sink into the Water: But should this Plank be more compact and weighty than a Mass of Water of the same Dimensions, it will descend to the Bottom.

In the second Place, the less Air a Body contains, and the more compact it is in its Parts, the greater is the Gravity it acquires; on the other hand, it proves lighter in Proportion to the greater Multitude of its Pores, and the larger Quantity of Air it contains. A Bottle filled with Liquor sinks in the Water, because the Liquor and the Bottle together weigh more than a Mass of Water of the same Bulk; but the same Bottle filled with Air floats on the Surface, because both the Bottle and the

* Transact. Phil. n. 114, 115.

Air have less Gravity than that Portion of Water whose Place they possess. In a word, all Bodies sink in the Water, when they are not in an Equilibrium with a Quantity of the Fluid that is equal to them in Weight.

Taking this for granted, the Body of a Fish which is heavier than the Quantity of Water whose Place it fills, must always sink to the Bottom; and this would be the unavoidable Consequence, if the Fish had not in his Entrails a Vessel fill'd with Air, which enables him to sustain himself in what Part of the Water he pleases: This Vessel swells the Fish a little, and enlarges his natural Dimensions, without making any Addition to his Weight, which is a Circumstance that deserves particular Observation; for by this Means he takes up more Space than he could possibly fill without the Vessel, and this brings him to an Equilibrium with the Mass of Water whose Place he occupies. I will make a Supposition, that the Fish, without the Vessel, weighs sixteen Ounces, and that the Water whose Place he fills weighs no more than fifteen; the Fish must in this Case infallibly sink. But if you then place in the Fish a little Phlogiston fill'd with Air, and which makes

Add

Addition to the Animal's Weight, but only enlarges its Body; this will then possess more Space. If the Water then, whose Place he takes up, should weigh sixteen Ounces, the Creature is in an Equilibrium with this Pound of Water, and will then be sustained in any Part of the River where he happens to find himself.

Chevalier. Hitherto all goes very well. The Fish is in a Capacity for swimming, and can advance in one and the same Line. But your Lordship does not tell me by what Means he rises and sinks.

Count. Were he capable of enlarging his Vessel or Bag, what would be the Consequence? Take a little Time to consider that Circumstance.

Chevalier. If he could enlarge the Bag, his own Body would be larger too, without any farther Consideration. I can comprehend that, my Lord. As he possesses the Place of a greater Mass of Water than he did before, he must certainly be lighter than that Water.

Count. You have not said all. If he becomes more light he will ascend. And, on the contrary, if the Fish contracts the Bag, what will be the Consequence then?

Chevalier.

Chevalier. He will diminish in Bulk and fill up less Space without losing any degree of his Weight; by which means he must be heavier than the Water whose Place he takes up, and will consequently descend. But it seems improbable, my Lord, that a Fish should be able every Moment to contract and dilate this Bag, according as he has Occasion to rise or sink.

Count. This, however, is what he is obliged to; and 'tis a Fact that has been demonstrated by unexceptionable Observations. This Bag is generally divided into two little Cells; one, as it should seem, is always equally fill'd with Air, to keep the Fish perpetually in an Equilibrium with the Mass of Water where he finds himself: The other Division of the Bag swells or contracts, to render the Fish more or less light; or, in other Words, to enable him to rise or descend, as he sees Occasion.

Chevalier. How is it possible for the Fish to have the Air at his Command in the Water?

Count. The Water abounds with Particles of Air diffused thro' the whole Mass. * What we commonly call the Gills of a Fish, are no more than a

* Hist. de l' Acad. des Sc. 1711.

Kind of Lungs, which he opens for the Reception of Air, and which have such a Mechanism in their Structure, that the Air is admitted without any Intermixture of Water. Through these Passages the Air evidently flows into the Bag, and then the Fish ascends: But in order to sink, he has no more to do than to contract the Bag; the Air then rises to the Gills and is ejected, and the Fish descends with a Rapidity proportionable to the Quantity of Air evacuated. However, it must be acknowledged, that if several Facts demonstrate that the Fish can breathe, and receive as well as eject some Bubbles of Air; yet the Conveyance of this Air into the Bag is not a very easy Operation, or capable of being immediately accomplished: I should therefore be of Opinion, that the Muscles of the Fish are his usual Expedients for contracting or enlarging the Bag; when he expands them, the Air is dilated, and the Bag swells; when he contracts them, the Air is compressed, and the Bag becomes less.

Chevalier. What his Lordship has related seems to me very curious, and I am persuaded it is all justified by Experience. I design to be convinced of the Fact by an Experiment of my own,

own, and shall order the Cook to prick the Bladder of one of my Carp, to let out the Air: The Fish will not die immediately, and I shall see whether he will sink to the Bottom.

Count. You will do very well. I love young People who are early in making Experiments and Reflections; by these Means they form and cultivate their Judgment, and nothing is more sure and important in philosophick Enquiries, than seeing with your own Eyes. But as to your intended Experiment, I have formerly made it myself. You have seen in my Closet a Machine called an Air-pump, and which extracts the Air out of a chrystal or any other Vessel that covers it. I one Day clapped in a living Carp, and when the Air was pumped out of the Vessel, I presently imagined, that the other Air which remained in the Bag of the Fish would be dilated, because the Air is perpetually making Efforts for its Enlargement, and there was then no external Air to gravitate on the Carp. The Affair succeeded according to my Expectation; the Air expanding itself in the Bladder swelled the Fish to such a degree, that his Eyes started out of his Head, and the Bladder at last burst in his Body: The Carp did not die,
and

and I threw him immediately into the Water, where he continued to live a Month longer.

Chevalier. But he could not rise any more in the Water.

Count. Very true; and therefore he crawled along the Bottom of the Pond like a Serpent *.

Countess. This Bag of Air really produces surprising Effects. But your Fish must certainly be great Philosophers, to know justly the Degree to which they ought to swell and contract themselves proportionable to their intended Elevation or Descent, and to be able properly to open or close the Air-vent, as well as extend or draw in their Muscles, suitable to such or such a Degree of Ascension in the Water.

Count. Our Reasoning must submit to Experience. But this Difficulty is solved, by considering, that the Fish perform all these Operations without any Consciousness of what they do; and the Exactness of the Execution, instead of discovering any Knowledge or Attention of the Animal in whom they are transacted, only manifests the unsearchable Wisdom of the Almighty Creator of all Things. With Respect

* Borelli. *ibid.* propos. 29.
Vol. II. p. 845.

Lowthorp's Abridg.

even to ourselves, whom God has endowed with Reason for the Regulation of our Actions, what a Number of Functions are carried on without our Participation? We breathe, without knowing either the Structure or Use of the Lungs; and how many People are even ignorant that they have any Lungs at all? We leap, we dance, we take a Minuet or a Rigadoon Step, and throw ourselves into a Variety of Gestures, without knowing either the Nerves we ought to extend, or the Muscles necessary to be relaxed, in order to accomplish such Motions.

Countess. I am not fond of Disputations, 'tis a disagreeable Character; but let me desire you, Gentlemen, to explain to me one Thing that seems inconsistent with what you have advanced. I may speak of what occurs to me every Day. Have we ever discovered any Bag like this in Lobsters who live in the Water? Is any thing of this Nature to be seen in Crabs and Tortoises, who expatiate in that Element in full Liberty. I am likewise of Opinion, that it is not possible to make this Discovery either in Soals or Plaice or any other flat Fish.

Count. We need not look for such a Bag in these Creatures, they have it not.

not, and indeed have no Occasion for it. * River Crayfish, Oyfters, Lobfters, and Crabs, never quit the Bottom of the Water, any more than Soals and flat Fish; for which Reason a Bag of Air would be ufelefs to them. The Fact is much the fame with Refpect to the Tortoise. I confefs indeed that this Creature has been † fometimes feen to fwim, becaufe as ſhe is accommodated with Lungs, ſhe can diſtend herſelf with Air, and be brought to an Equilibrium with the Water; but for all this, ſhe generally contents herſelf with creeping by the Affiſtance of her Paws.

Chevalier. I have indeed taken Notice, that the Creatures of this Species who are here in the Baſon where I have lodged my Fiſh, never ſwim, but crawl on the Earth in the Water as well as out of that Element. One may ſee them aſcend from the Bottom by the Aid of a Plank, and then take a Circuit on the green Turf that ſurrounds the Baſon; after which, they make a ſlow Return into the Water. This is an amphibious Animal, of a different Structure from the reſt. I wiſh his Lordſhip would juſt acquaint us with the ſeveral Species of this

* Lowthorp's Abridgment, Vol. II. p. 845. † Ron-dellet, lib. i. c. 10.

Creature that are of any singular Use to us. For Instance, are the Tortoises in the Bason the same with those whose Shells are used for Snuff-boxes and other Toys?

The Turtle.

Count. They may serve for such Purposes; but the Tortoises you see here are small and very common. There are four or five Species of these Creatures, the most valuable of which are the * Turtle and the Carret, as they are called: The former of these has not a very extraordinary Shell, but its Flesh and Eggs are very much coveted by Navigators, who find them an excellent Refreshment, as well as an infallible Cure for the Scurvy in long Voyages. A single Tortoise of this Species may produce Two hundred Pounds of Flesh, which the Sailors take Care to salt, and need Three hundred Eggs, which will keep for a considerable Time.

The Carret.

The † Carret is a very large Tortoise, as well as the other; his Flesh indeed is not so delicate, but he is much sought after for the Beauty of his Shell, which is fashioned as the Workman pleases, by softening it in warm Water, after which it is clapped into a Mould, whose Impression it immediately takes, by the Assistance of

* Diction. Savari.

† Ibid.

strong Iron Press; they afterwards polish and adorn it with Chasings of Gold and other Embellishments.

Chevalier. Before we quit the Article of Tortoises and Lobsters, I would fain know in what Manner they live; for if they don't swim, I should imagine their Prey might easily escape them.

Count. Lobsters and Crabs are furnished with a Couple of strong Claws, with which they fasten on the larger Prey, that inconsiderately happens to be near them. They search the Beds of Lime and Gravel for Worms, who there make their Retreat; they draw them out of their Lodgments with their little Pincers, and find a Collation ready prepared. As for the Tortoise, she feeds on Grass and Weeds in the Water as well as on the Land. She makes her usual Residence and finds her Aliment in certain Meadows at the Bottom of the Sea, near several of the *American* Islands. The Water is not many Fathoms deep in some of these Parts; and, according to the Relations * of Navigators, when the Sea is calm, and the Weather serene, the Tortoises are seen creeping on this green Carpet at the Bottom of the Sea. After they

* History of the Buccaneers.

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have

have fed sufficiently, they take their Progress into the Outlets of Rivers for fresh Water; there they take in a refreshing Air, and then return to their former Station. In the Intermiffion of their Feeding, they generally float with their Heads above the Surface of the Water, unless they are alarmed by the Motions of any Hunters or Birds of Prey, in which Case they suddenly plunge to the Bottom. They make yearly Visits to the Shore, where they lay their Eggs in Cavities in the Sand a little above the Edge where the Surges beat, and cover them very lightly that the Sun may communicate to them a gentle Warmth and hatch the Young; and whilst they are making Preparations for their Family, they furnish Mankind and Birds with a very plentiful Provision; for they lay the Eggs thrice at the Expiration of every Fifteen Days, and generally produce Fourfcore or Ninety, or even more, each Fecundation.

At the Conclusion of about Five or twenty Days, the young Tortoises are seen to rise out of the Sand, and without any Guide or Instructions march with a gentle Pace to the Water, but the Waves unfortunately throw them back on the Shore for the first five Days.

Days, and then the Birds dart on them and carry off the Generality, before they have sufficient Strength to make proper Efforts against the Surges, and dive to the Bottom. So that out of Three hundred Eggs, it is but seldom that more than ten escape, and sometimes they are all destroyed.

Countess. It should seem at the first View, that Nature in this Instance charges herself with an unnecessary Expence, or is even imperfect in her Operations. But the Falshood and Injustice of such an Opinion is immediately evident. We never find ourselves disposed to complain of the Fertility of a Hen, who frequently presents us with Three hundred Eggs in a Year, when not one Chicken is permitted to be hatched. We are very sensible that the Intention of the Author of Nature in this admirable Prolifickness, is to facilitate the Preservation of the Species, and at the same Time to accommodate Man and other Animals with an excellent Food: So that nothing in the Works of Nature is either lost or defective; and particular Advantages are derived even from the Slowness of the Tortoise's Motions; for were she more expeditious, what a Number of Animals would be frustrated of their Food?

Prior. Let us proceed in our Examinations of the various Benefits we receive from the different Species of Fish, and we shall discover through the Whole new Motives to adore Him who has replenished the Water as well as the Earth and Air, with all sorts of Blessings.

Count. Those very Fish who are disagreeable to our Palate, are nevertheless not unprofitable to Man. We have already observed, that the Northern Fish, whose oily Taste is offensive to us, afford a Sustenance to other People. The very Fins, the Scales, and most inconsiderable Parts of these Animals, are very serviceable to several Nations. There is one Species of Fish whose Fins are so very strong, that the Inhabitants of *Greenland* use them for sewing the Skins of Bears, which furnish them with their Dress, and which they tack together with Strings made of the dried Entrails that serve their Purpose instead of Thread.

The same People build the Hulls of their Vessels with the Bones of Whales and afterwards line them with the Skins of Sea Calves, or Whales themselves. A Man sinks half his Body into the Hollow of one of these Boats and sits with his Feet extended at the Bottom

Bottom, and the Extremities of his Coat of Skins perfectly cover the round Opening in which his Body is fixed. The *Greenlanders*, with their Left Hand, work a little Oar ending with a double Blade, and arm their Right Hand with a Harping Iron; and with this Equipage swim very lightly on the Water, braving the Tempests, and assaulting the Whales and Porpoises that afford them their Subsistence. These Boats are more serviceable, safe, and expeditious than ours, and indeed it is impossible for them to be cast away.

Chevalier. For what Reason then do we make no Use of them?

Countess. Would you have it said, that the *Europeans* are instructed in any Particulars by the Inhabitants of *Greenland*? You know we have all the Knowledge to ourselves.

Count. There is a Fish in the Northern Seas, from which the *Muscovites* extract a Glew that is extremely beneficial; it clarifies our Wines without the least Diminution of their Goodness, and never communicates to them any Quality of its own: Our Manufacturers use it to strengthen and polish the Warp of their Works; and it is frequently employed with Success, where even strong Glew will not stick.

The Glew
of Fish.

The Wal-
ruis.

The *Danes* and other Northern People catch a very large Fish called a Walruis or Narval, whose Teeth are more esteemed than those of the Elephant, because they are an Ivory of the purest Whiteness, and not subject to grow yellow. The Left Jaw of this Creature is armed with an Ivory Horn, extending sometimes to a Length of fourteen, fifteen, and sixteen Feet: These Horns are to be met with in the Cabinets of the Curious, and have been thought to belong to the Unicorn*, who is an Animal entirely chimerical, or at least undiscovered by the Moderns, whatever Knowledge of him might be among the Antients.

But of all the Species of Fish who are never brought to our Tables, the Whale is undoubtedly the most beneficial: 'Tis an Animal of a stupendious Size, an hundred and thirty, an hundred and sixty, and sometimes two hundred Feet in Length, and extremely profitable to those who engage in that Fishery.

Chevalier. How is it possible to conquer such a monstrous Creature? he must certainly rend and destroy whatever comes in his Way.

* The Unicorn is an Animal very different from the common Idea of him. See Bochart's Hierozoic.

Prior. The Fishery is exceedingly curious : Take this Description of it in a few Words : This Creature is found about the most Northern Parts of *Europe*, which are resorted to by a great Number of Vessels appropriated to that kind of Capture. When a Whale makes his Appearance on the Water, the most vigorous and bold Fisherman takes a Harping-Iron, which is a Javelin well steeled at one Extremity, and five or six Feet long, and to which is fastened a Line of above an hundred Fathoms in Length. When once this Instrument has been darted into the Fat and Flesh of the Whale the Affair is all over, the Animal plunges to the Bottom, and the Harponiers let the Line run out very quick. When they have not a sufficient Quantity to enable them to pursue the Fish in its Career, they fasten to the End of the Line a Gourd hollowed within, and well closed up, and carefully observe its Motion, that they may find the End of the Line, and know where the Whale conceals himself. The Creature, after losing his Blood, sometimes rises to the Surface of the Water, or else they drag him up with the Cord ; they then endeavour to get him into their Possession, they draw him to the Shore, and cut him in Pieces.

Chevalier. If the Flesh be not eaten, to what other Use is it applied?

Prior. The Fat of a small Whale about sixty or seventy Feet long, sometimes produces an hundred Casks of Oil; and a Whale of two hundred Feet in Length, generally yields sixteen or twenty Tons.

Chevalier. What may this Oil be good for?

Prior. It furnishes a very considerable Trade; They use it in dressing certain Skins, and it thickens the Pitch with which they kalk Ships; they likewise prepare Wool with it; and it proves a necessary Ingredient in Soap: 'Tis even employed in Painting and Physick: But it is more especially of infinite Use in the North, where it furnishes a frugal Light in the long and dismal Darkness of those Regions.

Countess. Do these great Fishes supply us with the Whalebone which we purchase of the Merchant?

Count. The Name of Whale is given to two Sorts of Fish; one is small, furnished with Teeth, and his Brain produces that white Substance called *Parmacity*, so much esteemed by the Ladies. The other is the large Whale, who is destitute of Teeth, but then he is supplied with two large Tusks, a dozen

dozen or fifteen Feet long, which rise out of his Jaws, and conveniently enable him to amass together the Weeds which are generally supposed to be his Food, because Quantities of them have been found in his Stomach. These Tusshes, split into small Divisions, are the pretended Whalebone, or that strong and pliant Substance we buy of the Merchant under the Name of Whalebone, and whose present Usefulness seems entirely confined to the Hoop-Petticoat; a Mode of Dress altogether senseless and unamiable, but which the Ladies have taken a Resolution to continue, because it gives them less Constraint than the Dress they have now disused.

Countess. What does your Lordship mean? In Matters of Mode, the weakest Heads prescribe Rules to the wisest. But let us not wander from our Subject. These great Whales put me in mind of an amphibious Animal, who is above an hundred Feet long, and whose Description you entertained us with the other Day.

Count. You mean the *American Cro-* Crocodiles
codile. But I would not give too much Credit to the Relations of * old *Spanish*

* See the Leviathan of Samuel Bochart. Hierozoic.
lib. 4.

Travellers,

Travellers, who are very apt to enlarge in their Descriptions. The Crocodile, who lives in the *Nile*, the *Niger* and some other Rivers of *Africa*, has no such Length; some of these Creatures are fifteen, eighteen, and twenty Feet long, but they very seldom exceed five and twenty, which is a Length sufficient to give the Animal a very monstrous and formidable Appearance.

Chevalier. Is not this the Animal who resembles a large Lizard, and has Jaws armed with Teeth ranged like those of a Saw, and a Body and Tail covered with large impenetrable Scales, and who, according to the Accounts given of him, very artfully seizes young Children when he discovers them on the Banks of the River in which he lies concealed?

Count. The very same.

Prior. This Animal, were he too prolifick, would reduce Mankind to the greatest Desolation. But God has prepared for him a couple of Enemies, who are always contriving his Destruction; and these are the Hippopotamus or River Horse, and the Ichneumon.

The Hippopotamus.

The Hippopotamus* is a very large amphibious Animal, who lives at the

* See the Behemoth of Bochart Hierozoic. l. iv. c. 15, 16.

Bottom of the *Nile* and *Niger*, from whence he rises, not by any Effort of swimming, but by crawling with his Four-Feet, when he goes to feed in the Meadows or even on the Tops of Mountains: He grazes in the Herbage, and then returns to his Station in the Water, where he is in a perpetual State of War with the Crocodile.

The Ichneumon is a Water-Rat or The Ich- little Dog, and the Crocodile's great neumon. Terror. Some Travellers assure us, that he creeps down the Crocodile's Throat when he is asleep, devours his Entrails, and kills him with extream Pain; after which, he feeds on him at Leisure. Others inform us, that they are unacquainted with this Fact, but have frequently seen the Ichneumon throw himself on the Eggs left by the Crocodile in the Sand, and which he destroys to the utmost of his Ability.

Count. If the *Chevalier* has any Curiosity to see the Figures of the Crocodile, the River Horse, and the Ichneumon, comprehended in one Piece of Sculpture, he must go to the *Tuilleries*.

Chevalier. To what particular Part, my Lord?

Count. Have you never taken Notice of a Statue that represents the *Nile*,
with

with fourteen other Figures of its young Offspring?

Chevalier. I have frequently seen it, without comprehending any Part of the Statuary's Intention: Pray what may be the Signification of all this Progeny, and the Figures that are on the Edge of the Basis?

Count. The fourteen Children of the *Nile*, some of whom are placed above, and others below, are the Symbols of the different Risings of the *Nile*, which are extremely beneficial to *Egypt* when they ascend to the Height of fourteen Cubits; and the Country is threatned with Famine when the River has a less Elevation; if it swells to fifteen Cubits, a great Plenty infallibly succeeds; but when it rises to sixteen, the Consequence is entirely different. Fourteen Cubits are the necessary Standard. Under the Figure of the God of the *Nile* leaning on his Urn, is a large Bed of white Marble, round which you will see in Relievo, the Objects peculiar to *Egypt*, such as the *Lotus*, a Plant with which the *Egyptians* make a Kind of Bread, or broad thin Cakes; the Ibis a Kind of Stork, who purges the Country from Serpents; and the Ichneumon and River Horse, combating the Crocodile.

Countess.

Countess. Gentlemen I have permitted you this Day to discourse on every Subject you thought proper, but I intend to make a better Use of my Prerogative as President, and shall recall you to those Subjects that are more suited to my Capacity. I propose to the Company for our next Conversation, the Article of Plants, with their Flowers and Fruits. After my Birds, this is the Subject wherein I have most Experience.



PLANTS.



PLANTS.



DIALOGUE XIV.

The COUNT and the COUNTESS.

The PRIOR and the CHEVALIER.

Countess.



CHEVALIER, we make you a Proficient in all the Arts and Trades in their

Turn. You have already gone through those of an Hunter, a Weaver, a Fowler, and a Fisher : To-day we shall teach you to be a Gardiner.

Chevalier. Must we Part with the Article of Animals so soon ? There are vast Numbers of them who have never been the Subject of our Conversations.

His

His Lordship, though he has no great Esteem for the Theatre of *Russian* Animals, permits me to view the Figures which are very numerous in that Work. I looked them over Yesterday, and did not see one new Animal whose Name, Residence and Profession I had not a Curiosity to know. I fancy it would be very entertaining to be acquainted with them all.

Count. This is the very Inclination I was desirous of inspiring you with. Each Animal merits a particular Consideration and Study. The very Trunk of an Elephant would furnish sufficient Matter for several Conversations: But we don't intend to exhaust every Subject, and fatigue you with too many Particulars; we only desire to raise in you an Inclination to these Amusements, and after we have made you sensible, that much greater Advancements are practicable, 'tis proper to leave the rest to your own Examination.

Countess. But do you imagine, *Chevalier*, that we turn the Conversation from Animals, when we discourse of Plants? No surely, for even these are a Species of Animals, who, though they don't move from Place to Place, have yet their proper Sustenance, and become

come Founders of a numerous Posterity as well as those who can march up and down.

Prior. What her Ladyship advances in a Vein of Pleasantry, has a very great Air of Truth. The Root, according to Observations, supplies the Plant with a Stomach for digesting the Nourishment; the Bark is a Skin which covers all the Vessels; the Stock is the Body of the Animal; and the Sap, which ascends from the Root to the Branches, and then returns from the Branches to the Root, has a perfect Conformity to the Blood that circulates in the Bodies of Animals.

Count. What is your real Opinion of this pretended Circulation of the Nutrimental Juice? Are you persuaded it is Fact?

Prior. Every Circumstance seems to intimate the Affirmative; but before we undertake to discuss this Point, we should do well to consider the Origin of all Plants, and their essential constituent Parts; after which we may come to the Manner of their Nourishment.

Count. I am willing we should proceed in this Method. *Chevalier*, do you recollect the general Origin of all Plants.

Chevalier.

Chevalier. They rise from Seeds.

Count. Do you believe then, that the Earth cannot with its Heat and Juices form a Plant at once without the Concurrence of Seed?

Chevalier. It cannot produce the The Ori-
gin of
Plants. least Blade of Grass. I remember your Lordship told me, with Relation to Animals, that the Earth nourishes every Individual, but cannot form an organized Body. The same Order and Design, visible in Animals, is to be discovered in Plants. The Juice of the Earth may indeed nourish a Plant, and that is the utmost of its Operation, but it cannot give it a Form.

Count. In Reality, if the Juice of the Earth could produce Plants, it must be endowed with all the Omnipotence of the Creator, in order to give an instantaneous Existence to the Roots, the Ducts, the Fibres, the little Vessels appointed for the Reception and Distribution of the Sap, the Glands to filtrate and proportion it to the Delicacy of the Vessels into which they give it Admission, the Vents or breathing Holes to receive and diffuse the Air; in a Word, all the Parts of a Plant, as the Bark, the Wood, the Pith, the Buds of Branches, Flowers, and Fruits, this Juice must be gifted with Intelligence

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to be capable of such a Variety of Operations, and never by Mistake, to cause one Plant to produce the Gems and Fruits of another Species.

Chevalier. I am not able to comprehend how any one can think the Earth qualified to form the Body of a Plant. I would as soon say it had produced Mankind as well as the Moon and Sun.

Count. I am exceedingly delighted at your discovering the Necessity of resorting to the Agency of an Almighty Being. He, indeed, is incomprehensible, but without him it is impossible for any thing to be intelligible. But when his Interposition is once supposed 'tis easy to conceive the Possibility of producing all Things. He alone was capable of forming the Matter which constitutes all Bodies, and none but himself could extract out of this Matter several Elements, each of which perpetually the same, notwithstanding by their different Combinations, they form an infinite Variety of Bodies. These Elements may indeed make mutual Approaches, and intermingle with each other, but the Result will be no more than an Heap of confused Masses; they will be neither Organs, nor Life, nor Soul. Let us suppose the Earth to
new

newly created, it will for ever continue naked and barren, if it be not arrayed and peopled by the Deity. He alone can organize Bodies, and animate such organized Species as Plants and Animals. The minuteſt Sprig of Sorrel or Chervil is formed, like all the reſt of the Creation, by a particular Plan, and a ſpecial Will.

As to the Manner of perpetuating Animals and Trees after their firſt Formation, he might either determine to create more, when ever it ſhould be neceſſary to ſubſtitue a new one in the Room of another, that Age had decay'd; or he might, at once, provide for all ſucceſſions of Ages, by incloſing, in the Seed of the firſt Tree, all its Poſterity in Miniature; ſo that each Species muſt unavoidably produce its own Reſemblance, and the Earth would be on-charged with a Contribution of Juices neceſſary to nourish and unfold the Seed; and, indeed, this is the magnificent Order he has been pleaſed to eſtabliſh. The Imagination is aſtoniſh-ed to find Millions of Seeds involved one another; but Reaſon teaches us to receive the Fact without Heſitation, becauſe the Power of the Creator is omnipotent.

Prior. Be upon your Guard, *Chevalier*, you will receive a brisk Attack from me. There are some Plants, such as Mushrooms and Fern, that don't exhibit any Seed to our View, and yet shoot forth daily, and grow in different Situations; God must therefore either create them a new, or the Juices of the Earth put into Motion are qualified for the Production of organized Bodies.

Chevalier. I don't know whether your Lordship may be a Prophet, and knew four Days ago that you intended to embarrass me with your Fern, but however, he furnished me with the Answer I shall now give you. He directed me to place my Ear close to a Paper where at first I was not sensible of any Noise, but I afterwards heard a fine Sound or Crackling that made me very attentive to discover the Cause: At last I then observed a Number of little Grains skipping over one another like Mites in a Cheese; but by the Aid of a Microscope, I had a very different View, for these Grains were a Parcel of Shells that contained a Quantity of Seed. The Dryness of these Shells made them crack, and the small Grains shot and dispersed themselves upon the Paper down. These, Sir, were the very Seeds of Fern, and now you may tell

if you please, that this Plant produces none.

Prior. But you are silent as to the Mushroom.

Chevalier. Give me leave to tell you, Sir, that you are not easily satisfied: Were' it true that we cannot discover any Seeds in a Mushroom, I would still maintain that it does not want them, though they are too small to be visible, and so very light that they are wafted up and down by the Wind.

Count. The Fact is undeniable, if in this Particular we may judge of the Conduct of the Deity, by that which he never departs from in ten thousand other Instances.

Countess. Every Plant is produced The Seed. by Seed. This is a Truth familiar to our Experience; but let us inquire into the Nature of a Seed, and what it discovers to our View. You, Gentlemen, who have examined these Particulars with your Glasses, can give us some Light into the Affair.

Count. Let us begin with the external Appearance. All the Seeds of Plants The Manner in which Seeds are enfolded and covered. have different Sheaths, which inclose them till they are lodged in the Earth; they are capable of being turned, measured, and heaped up without the least prejudice, because they are invested

with a Covering, and defended from Danger. Some of these Seeds, as the Kernels of Apples and Pears, are placed in the very Heart of the Fruit, whose Substance consequently performs the double Function of enfolding the Seed whilst they continue tender, and nourishing Mankind, when the Seeds, in their State of Perfection, no longer want a Surtout. Others grow in Shells, and of this Sort are Peas, Beans, Lentils, Poppy Seeds and Cocoa Nuts: A third Sort, besides the Substance of the Fruit, are shut up in thick Shells of Wood, and of this Species are Wallnuts, Almonds, Apricocks, Peaches, Plums, and other Kinds: Several, besides the Wooden Shell, have likewise a bitter Rind, which is the Case of Wallnuts, or a covering shagged with Prickles, to preserve the Seeds from all Injury till they have compleated their Maturity. Chesnuts belong to this last Class.

Chevalier. I find that Fruits of moderate Goodness have a Variety of Preservations; but in my Opinion, the Peach, which is so excellent, is much more intituled to the Protection of a strong Shell; we should then enjoy it for a longer Season.

Prior. Give me leave to tell you, *Chevalier*, that God is equally

and fertile in his Operations: He has furnished the Generality of Seeds with a Covering of Wood, and has not thought it proper to afford one of equal Strength to the Substance of Fruits, which in reality is no more than a Covering or Defence to the Seed: He has inclosed some particular Fruits in a light Skin, others in a solid Bark: He alone fixes the Regulations, and is not subject to any Restraint. But though it is incumbent on us only to celebrate His Choice of one Method in preference to another, we may be sometimes indulged in a modest Attempt to discover the Reason of such a Conduct. The Peach and Plumb are appointed for our Refreshment at the Close of the violent Heats; in any other Season they would chill us, or at least would be depreciated by the Variety of other Fruits. As therefore their Appearance is limited to a short Period, their Clothing is proportioned accordingly, and a simple Gawse is sufficient. The Apple and Pear, which are intended to succeed them, and continue even in the Winter Season, have received a more compact Array: For which Reason, Chesnuts, and other Species of Nuts, that are to last all the Year, are still fortified in a better Manner. Chesnuts

are the Food of whole Nations: The little Birds would destroy them in their tender State, and therefore, in order to preserve them from such Insults, Nature has shagged their Outside with Prickles; and, perhaps, intimates to us, by such a Precaution, that they are capable of furnishing us with more considerable Advantages. Nuts are the Sustenance of several Animals as well as Men: They produce an Oil proper for burning, and which likewise preserves our Paintings and other Furniture, and gives a Soupleness, Strength and Cohesion to Leather. The Walnut is delicious even in its State of Immaturity, and furnishes our Tables with a Regale comparable to the finest Peach. Such a delicate Food would attract all the Birds and deprive Man of many Conveniences, did not the bitter Flavour of the Rind prevent the Birds from piercing with their Bills.

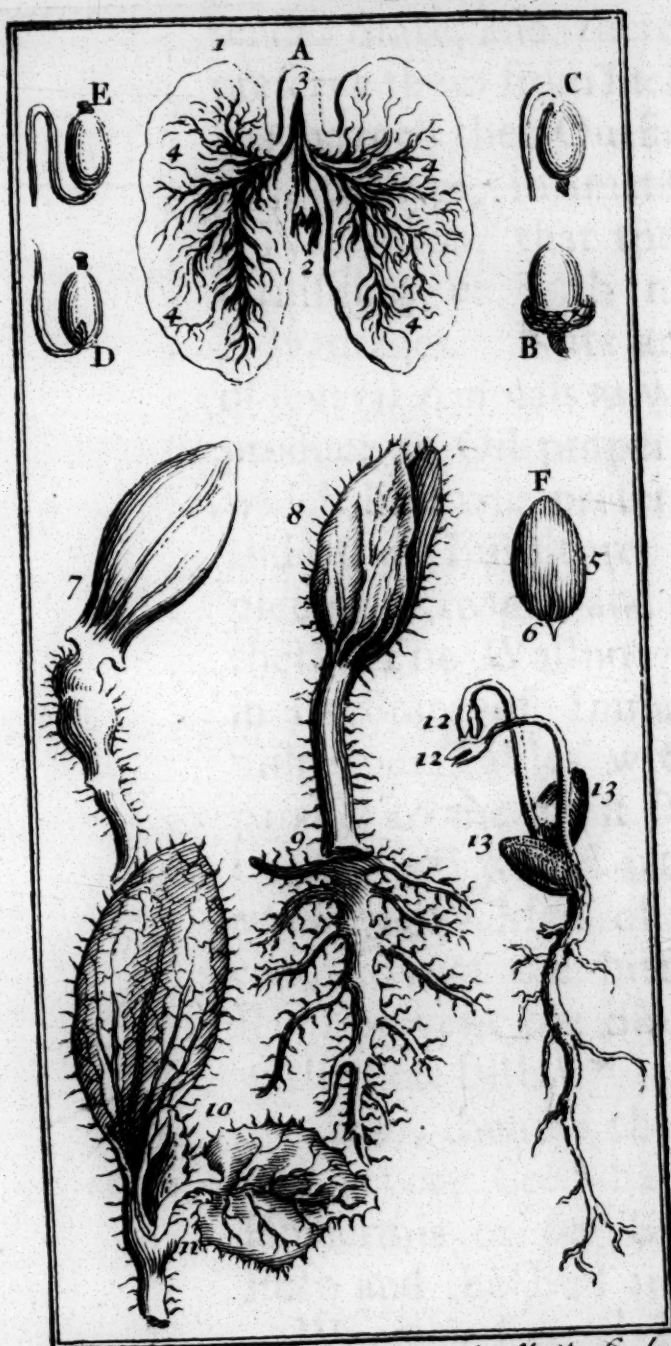
The Epi-
dermis.

Count. Besides these outward Foldings, every Seed has its Bag, and its Epidermis or fine Skin, in which the Pulp and the Bud are involved.

We may form a Judgment of all other Seeds by the Structure of a Pea Bean, or the Kernel of a Melon: The Texture is very near the same throughout the whole. Take away the C

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Part II. p. 169.

A. Motte sculp.

vering which enfolds a Bean or any other Seed you please, you generally discover two Pieces which part in your Hand, and are called the Lobes of the Seed: These are nothing else but a Composition of Meal, and the nutritional Juice or Sap of the Earth, which form a Pap or milky Substance proper to nourish the Seed.

At the Top of the Lobes, the Bud is planted and sunk in like a small Stud, the Head of which lengthens a little into a Point: * A Stock and a Pedicle are its Composition: The Point of the Stock or Body of the Seed rises towards the Top of the Grain; the Pedicle sinks towards the Bottom.

The Pedicle or Tail of the Seed is fastened to the Lobes by two Bands, or rather branching Tubes, whose Ramifications are dispersed through the Lobes, from whence they are appointed to derive the Juices necessary to the young Plant.

The Stock or Body of the Plant is enfolded by two Leaves that entirely surround it, and keep it fixed as in a Box, or between a couple of Scales.

These two Leaves are the first that disengage themselves from the Seed and

* Malpighi Anat. Plant.

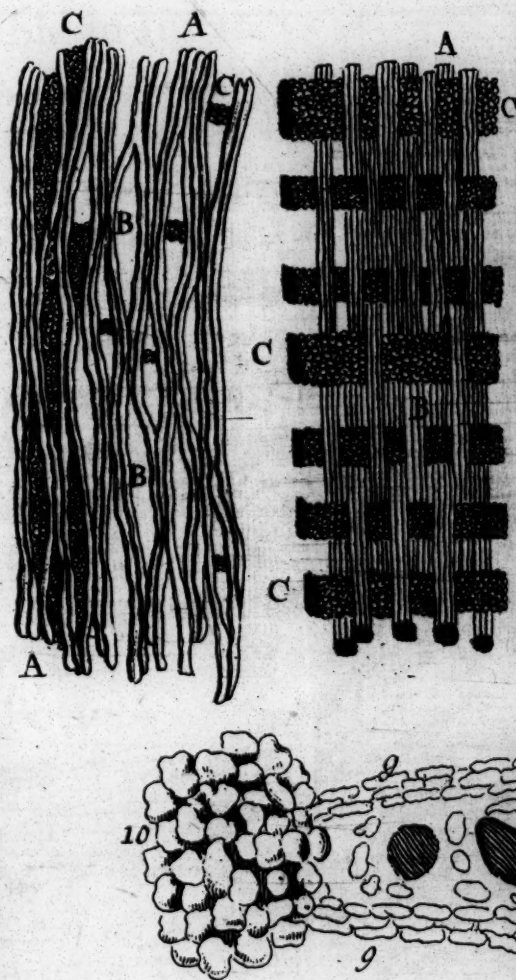
the Earth, and are the Harbingers of the Progress of the Trunk, the exceeding Delicacy of whose Texture they preserve from all Collisions that would prove injurious to it, and perhaps they may be serviceable in Instances of quite another Nature. As both these Leaves are very different from the true ones, and are the first that rise from the Seed to preserve the tender Infancy of the Plant, they are called the Seminal Leaves. There are some Seeds whose Lobes extend themselves out of the Earth, and seem to perform the same Functions as the first Leaves.

The
Root.

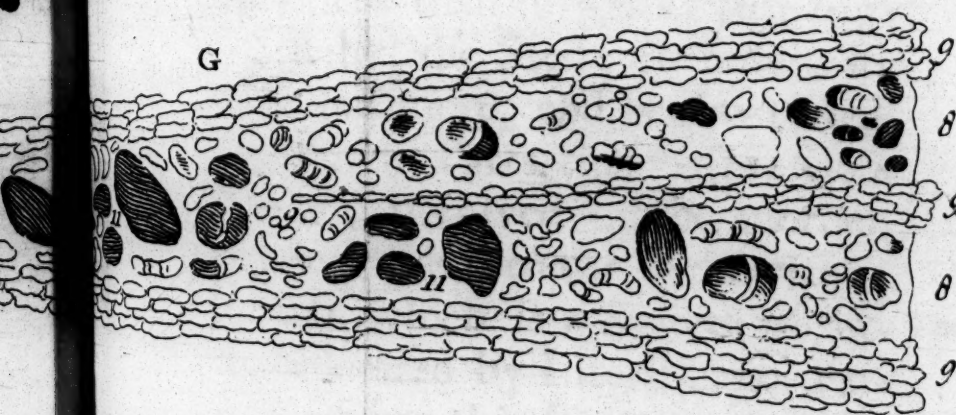
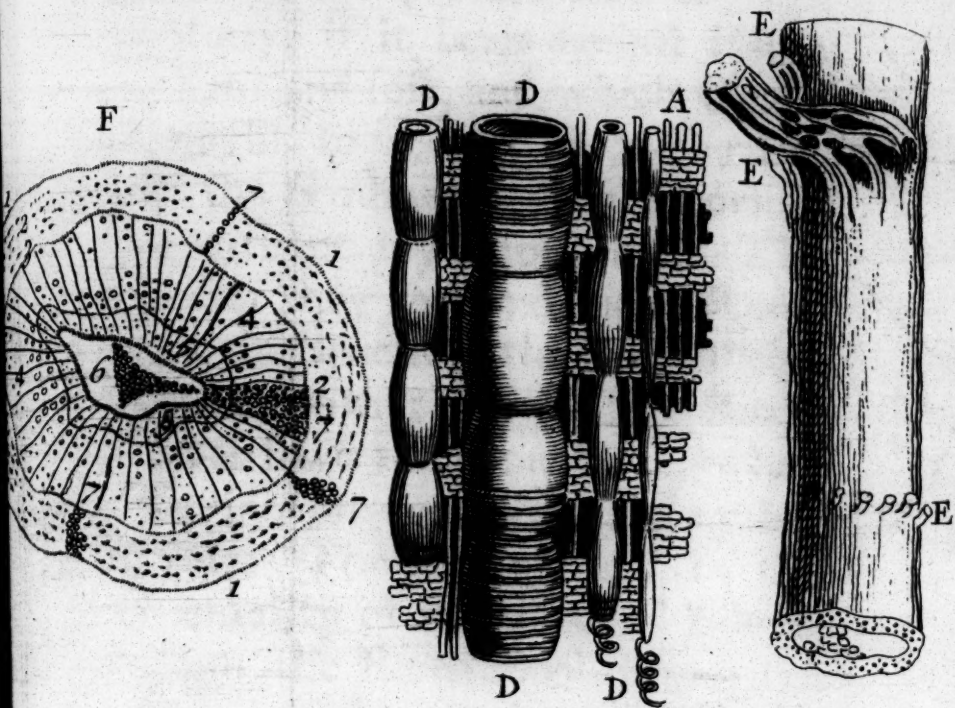
After the little Root has been nourished by the Juices it extracts from the Lobes, and has, by degrees, penetrated to the Bottom of the Seed and Lobes, it meets with a little Opening which is discoverable by a Microscope in the Wood of the hardest Nuts, as well as in the Skin of the Seed: Through this Aperture the Root passes, and shoots into the Earth several Fibres, which are so many Canals for the Conveyance of the Sap into the Body of the Root, from whence it rises into the Trunk, and gives it its Elevation in the Air. If the Trunk meets with any Ground clothed with a compact Turf, it turns
aside



Part 2.^d Page 170.



A. Motte Sculp^t.



aside into another Direction, being unable to pierce through the first Obstruction, and sometimes bursts and dies for want of Force to proceed further : On the contrary, if it bears against Earth that is light and soft, and which Qualities it ought to receive from the Labour of the Gardiner *, it then pursues its Way without any Impediment. The Lobes, after they have exhausted themselves for the Benefit of the young Plant, either rot or wither away : The Seminal Leaves have the same Fate ; when their Services are compleated, they begin to fade. The young Plant, by the Instrumentality of its Root and Fibres, draws from the Earth more strong and copious Juices than it was at first supplied with by the Seed ; it fastens itself more and more, and begins to unfold its different Parts, that before were rolled up and involved in one another. Let us now proceed to the Parts within.

The Pith, which is a System of little Cells seperated by Interstices or Partitions of a very thin Texture, is lodged in the Heart of the Trunk and Branches ; and there great Quantities of Sap are discovered. The Pith.

Round the Pith a Multitude of hollow Fibres rise in lateral Ranges, The Wood.

* Hoc imitatur arando. Virgil. Georg. 2.

which

which ascend the whole Length of the Plant, and are compacted together by several Fibres passing in an oblique Direction from one Range to another, and frequently crossing each other like the Figure of an X, or the Meshes of a large Net, in such a Manner that these Fibres frequently admit of Spaces between them, which are sometimes in the Form of Lozanges, sometimes square, but generally oblong. This System of long Tubes, that ascend round the Heart, form what we properly call the Wood, and are appointed to convey the Sap.

The
Bark.

Round the Wood is another Assemblage of hollow Fibres ranged almost in the same Manner, and these are called the Bark. There are three Parts to be taken Notice of, which differ from one another; the inward Bark or fine Skin immediately contiguous to the Wood; the Epidermis or outward Skin, which is a Net extended over all the exterior Surface of the Tree, and the intermediate Bark or thick Substance between the two preceding Skins.

The fine
Bark.

The fine Bark has a very singular Use in Trees: It seems to be a Collection of little Skins, or a Tissue of Fibres glewed over one another; the first
inward

inward Round of which disengages itself from the rest in the Spring, and adds a new Circumference to the Wood through its whole Length. Trees, like Insects and Reptils, have several Skins folded over one another, but then Reptils and Insects divest themselves of these first Skins, and entirely quit them, to appear from Time to Time in a new Form and another Array; whereas Trees have annually a new Habit, but then it is cast over the Precedent, the Bark serving for a Surtout. And it is evident that the fine Bark furnishes the Tree with the Rounds of Fibres that yearly enlarge its Bulk, because when the large Bark, with that which is inward, is cut off in any Part, leaving the Wood exposed to View, you must never expect that the Wood will receive any Augmentation there: Both the Bark and the Wood continue their Growth in the adjoining Parts, but the Aperture remains as it was first made, and can only be closed up in a long Process of Time by the lengthening of the Protuberances formed by the neighbouring Fibres.

'Tis easy to distinguish these annual Accretions in Trees; one need only cut a Trunk or a large Branch horizontally to discover the several Circles or different

different Degrees of Thickness round the Heart, and one may infallibly determine the Years of the Tree's Age by the Number of Circles visible in the Wood: The last Revolutions are always of a lighter Consistence, and are called the sappy Parts of the Wood, which are rejected by the Workmen as too weak to be any way serviceable to their Purpose. These soft Parts in the succeeding Years contract a Solidity, become more compact, and in no Particular differ from the real Wood. The Tree, by its perpetual Increase in Strength and Circumference, forces the Fibres of the Bark to stretch and extend themselves, and the outward Surface sometimes bursts with a surprising Noise, and this occasions the Crevisses which are always enlarging in the external Bark, in Proportion to the Growth of the Tree.

The Sap
Vessels.

We have observed, that the large Bark, as well as the small, the sappy Parts, and the real Wood, are composed of long Rows of Tubes or hollow Fibres that ascend and join together, or have a Communication with one another by the Agency of transverse Fibres, and there must consequently then be several Spaces between these Fibres; all these Kinds of open Meshes are fill'd with

with little Vessels or Bags of an oval Form, pierced at the two Extremities, and joining to one another at each End something like a string of Beads; They extend in an horizontal Line from the outward Bark cross the other two, and so to the Pith itself: These Vessels are generally fill'd with Sap.

Besides the Fibres that ascend from the Root and constitute the Wood and Bark, there are other Vessels disposed in the same Manner, and ranged along the Fibres, at proper Intervals of Distance; through all the Substance of the Wood, these form the Air Vents, and the Vessel properly so called.

The Air Vents are a Set of Tubes composed of Fibres revolving in a spiral Line like a Vice, and in one Part extended in little Ramifications to the external Air; and in the other, continued and enlarged to the very Root: These Vessels are always empty.

The proper Vessel is a large Duct fill'd with Oil, extended in Length between the Fibres of the Wood, and rising like the Air Vents to the Top of the Plant, and the external Air: I call this the proper Vessel, because it contains an Oil which varies according to the Nature of the Plants, each Species being impregnated with a gummy Fluid,

Fluid, proper, and, indeed, peculiar to it. In some Plants this Vessel contains a Kind of Turpentine, in others, 'tis a Sort of Rosin or Pitch; here it proves a Gum, and there it is a Species of Milk: 'Tis elsewhere a real Oil, and sometimes it assumes the Qualities of an Honey, a Syrop, or a Manna.

The
Knots.

We must now bestow a few Words on the Origin of Knots, and the Nature of the Buds that are always lodged in them. Towards the Top of the Plant, and in some other Parts of the Trunk and Root, Rows of little Branches shoot from the Body of the Wood, united and interlaced with each other; these traverse the Wood, the sappy Substance and the Bark, and their Extremities are projected to the external Air: These Rows are composed of hollow Fibres, proper Vessels, and especially Air Vents or empty Tubes. The Conjunction of so many different Vessels swells and enlarges, in some Measure, that Portion of the Bark in which they terminate; and this is what we call the Knots, the whole System of which is calculated for the Service and Growth of the Buds. These are so many little entire Plants, all furnished with their Vessels and other Parts rolled over one another like Threads wound into

into a Ball: The Outside is defended by several Foldings, and they are lodged in the Knots of the Tree, that they may extract in their Turn all the Nourishment necessary to their Expansion: I say in their Turn, because these Buds are subject to the same Process that appears in the Eggs or Seed of the young Offspring of Animals; there are Degrees and Diminutions in the Advancement that reach, as one may say, to Infinity itself. The Wisdom and Goodness of the Creator is as conspicuous in this Oeconomy, as his Power, since it not only supplies us with excellent Fruit this Year, but reserves a Liberality of the same Presents for the next; and by preventing all the Buds from opening at the same time, by unequal Preparations, he treasures up for our Tables and Fires, a Stock of Supplies that are really inexhaustible.

Our Observations have hitherto been The Root. confined to the Parts of the Trunk or Body of the Tree; we will now proceed to the Head and Root. This latter appeared to be only a Continuation of the same Parts we have taken Notice of in the Trunk: The Fibres that The Fibres. shoot from it on every Side, are probably an Extension of all the lesser Vessels that terminate athwart the Bark,

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and

and these form Knots to recruit the Tree both in the Earth and without : In the latter Situation, when the Tree is strip'd of its Branches ; in the former, when some Accident has deprived it of its Root : All these little Vessels inclose others of the same Structure and whose Minuteness is inconceivable : all of them likewise having other Knots and other Buds, and Means without End to preserve the Tree, and perpetuate the Species.

Slips and
Layers.

We discover the Proof of this amazing Arrangement in Slips and Layers. A Slip of the Willow or Gooseberry tree ; or, in other Words, a simple Stick of each Species, immediately takes root when stuck in the Ground.

The Branch of a Vine laid and bent into the Earth, shoots out Fibres through the Knots that are buried. Cut the Branch off where it joins with the Stock, and the other End that rises out of the Ground becomes a new Vine.

Shoots.

The Strawberry Plant spontaneously throws out on all Sides Trains or long Shoots projecting in several Knots, which extend their Fibres in the Earth, and become so many new Stems. The Water and Salt, the Oil, Air, and Fire which contribute to their Growth, are not furnished with any Intelligence to enable

enable them to design or form, to place or play off the Instruments necessary to the Life of the new Plant : All these additional Roots that spring from Knots, frequently Imperceptible in the Slips and Layers, were lodged there in Miniature, and are only a System of Branches which constituted the Knots of the Stock, and which are then lengthened and disengaged from their former Constraint, and conducted under the Earth, according as the Sap flows into their Apertures.

As to the Knots and Buds which form ^{The Head} the Head of the Plant, by furnishing ^{of the} it with Branches, Leaves, Flowers, ^{Tree.} Fruits and Seed, a particular Account of their various Manners of expanding themselves would be endless: Let us content ourselves with observing, that the Branches and the Pedicle of both Leaves and Flowers, are so many Extensions and new Distributions of all the Vessels we have seen in the Stock ; that these Vessels afterwards expatiate more at large through the whole Extent of the Leaves ; that the Fibres of Wood are distributed in long Ranks which we call the Ribs ; that these Fibres sustain the Air-Vents and the Vessels of Oil ; that the Orifices of the Vents and proper Vessels are on the upper Part of the Leaf and open to

the Sky; in a Word, that cross the Fibres, and in the whole Substance of the Leaves and Flowers, a vast Number of little Vessels are placed in horizontal Lines, the Plenitude and Variety of whose Juices fortify the Leaf and Flower, and paint them with their different Glow of Colours.

These, my dear *Chevalier*, are the Particulars we have frequently discovered with our Microscopes in the Generality of Plants; and, indeed, they are no more than a short Sketch and imperfect Outline. We must now animate the whole System, and shew you the Progress of the Sap, and the proper Juices. But if all these minute Parts are difficult to be distinguished, the Use of each Vessel, and the Course of their Fluids, are attended with much more Intricacy. I have frequently attempted to discover the Cause of the Sap's Motion: I think I have observed its Circulation, and had some imperfect View of the Manner in which it is performed, but I durst not attempt any Thing on that Article.

Chevalier. Perhaps the *Prior* may not so timorous.

Prior. I will venture at one Conjecture, and let it be regarded by the Company no otherwise than as it may appear natural and agreeable to Experience.

rience. It seems to me that the Impulse of the Air is capable of circulating the Sap through the Vessels whose Structure has been described to us, and is sufficient to produce the several Kinds of Progress, and all the Variety of Accidents visible in Trees.

If Plants are furnished with these Vents or Wind-Pipes, the Intention certainly must be to promote a Transpiration of Air; and if they breathe this Element like Animals, it must produce in them some of the Effects that it accomplishes in these. The Motion of the Blood and other Fluids, in living Creatures, seems to be effected by the Air, because when the Communication of this is intercepted, their Blood immediately grows thick and coagulates: The Air then, in all Probability, is the Principle of the Motion and Progress of Sap in Plants; and two Circumstances concur to produce this Operation; one is the Elastic Power of the Air, or that Spring with which it expands itself in Proportion to the Heat that penetrates its Parts, and the Dimensions of the Place where it obtains more Freedom; the other is the Structure of these very Air-Pipes, whose Spiral Rings, as they are capable of Extension, Tumefaction and Enlargement,

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naturally

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naturally put all that surrounds them in Motion.

The *Chevalier* must not be startled at the Word Elasticity or Spring: 'Tis known by Experience, that the Air shrinks, and is compressed by the Cold, and is dilated and enlarged by Heat. The various Changes of the Seasons make us sufficiently sensible of these Effects, and of which we may have a tollerable Idea, by comparing the Body of Air that surrounds us, to several Locks of Wooll thrown together in a Heap: Press this Wooll, and you will find it immediately shrink and contract itself under your Hand; but when it is left to itself, it swells and takes up more Room: 'Tis the same with Respect to the Air. The only Difference that can be thought of, is this, the Fibres of Wooll have but little Force, whereas the Particles of Air are actuated by such a powerful Spring, that the Moment they are released from their Confinement, they expand themselves with surprising Violence, and frequently shatter whatever opposes itself in their Way. Let us apply this Spring to Plants.

The Gardiner opens and turns the Earth with his Spade or Plough; in this Earth a Multitude of airy Particles
are

are lodged, and when, at the Return of Spring and the first Heats, the Atmosphere or Body of Air, which gravitated upon us by the Pressure of the Cold, begins to rarify and expand, and becomes subtilized by the Rays of the Sun, these returning Heats likewise communicate their Impressions to the Air in the Bowels of the Earth, upon which it begins to dilate in some Degree, and endeavours to break from its Confinement ; it acts upon, and strongly presses the Matter that surrounds it, and forces into Motion all the Water, Salts, and Oil it meets with under the Earth : These Elements being thus work'd into Activity, insinuate themselves into the little Orifices of the Seed, and all the Pores of their Covering ; the small Vessels that fill the Seed being so many empty Bags, whose Mouths are always unclosed, are easily fill'd in their Turn ; and as they are open at each Extremity, the Sap passes from the first Tube to the second, and so to the rest in Succession ; by which Means it moistens them all, and in less than the Space of twenty-four Hours, flows to the Pedicle or Root through the hollow Branches which are dispersed from all Parts of the Lobes, and re-united in two different Parts of the Root : This

Root, as well as the Stem of the Plant and the Seminal Leaves which cover that Stem, are likewise fill'd with hollow Vessels that drink in their Turn, and quickly improve their Growth with what they receive from the Lobes. All these little Vessels being swelled in this Manner, gradually raise and enlarge the Fibres they traverse; these too have their Nourishment, and consequently lengthen and swell. The Root continues to shoot out, and in a few Days arrives at the little Passage that opens at the Bottom of the Seed, and then receives the nutrimental Juices of the Earth which flow into the Extremities of its Fibres. The Stem and Seminal Leaves being enlarged and animated by the same Process, and daily pushed forward by new Juices, mount to the Surface of the Earth. —

The Direction of the Stem and Root.

Countess. With your Permission, I must interrupt you here. When a Husbandman Sows, he scatters his Corn at Random, and a Gardiner in planting Peas or Beans neither observes the Top or Bottom of the Grain. If this Grain is inverted, so that the Stem is at the Bottom, and the Root uppermost, by what Means can this little Stem rise into the Air? And who gives the Root to understand, that its Office is not to ascend

ascend, but to sink and continue in the Earth?

Prior. This however is the Conduct they always observe, and the Root itself, after it has sprung upwards a little, falls into a contrary Deflexion, and bends and sinks downwards into the Ground. *The Stem, after it has penetrated to a small Depth, always takes a different Turn, and at last rises to the Surface of the Earth, and generally continues its Ascent into the Air in a strait Line, without bending either to one Side or the other, unless it be one of those Plants whose Fibres are contorted and weak, of which Nature are those that form the Vine, the Ivy, the Hop, and several others; in which Case, Nature has provided them with Tendrils, twisting Sprigs, and other Conveniencies for fastening on what comes in their Way, and supporting themselves on a Prop: But the Root of a Plant generally shoots into the Earth, and the Stem rises out of it, and ascends perpendicularly into the Air. This is certainly as it should be; but the Difficulty is, to account for the Efforts they seem to make in order to disengage themselves from any Obstacle to their appointed Progress. We don't imagine them to be capable either of Understanding

*Memoir. de l'Acad. 1700, 1701, Nieuwentyt Grew.

standing or Choice. All these Tendencies, from which there are so few Deviations, are, in my Opinion, naturally accomplished by an Impulse of the Air. The Particles of this Element, which the first Heats begin to unfetter and disengage, meeting, at the Bottom of cultivated Land, with all the Resistance of an hard and untractable Mass, turn their Efforts on the soft Earth, and there cause all the Juices to rise. The Sap, chased from its former Situation, escapes through all the Passages that are open to it, and winding either in a direct or oblique, Flow through the Root and its capillary Branches; all these supple and pliant Fibres must unavoidably comply with this Impulse, and gradually sink into the Earth, whatever Track might be first taken by the Root. The Sap being put into Motion in the Stem, and pushed on by that which succeeds, mounts upwards, and it naturally draws to the same Quarter the Seminal Leaves; which, besides this, in forcing their Way upwards through a few Inches of light and porous Earth, find not so much Obstruction as they would meet with from the Earth below and on each Side; and so true it is, that the Ascent of the Sap forces the Root into a contrary Direction,

on, that we have frequently seen Acorns and other Grain, even out of the Earth, shoot forth in moist Places, and for some Time raise their Root upwards; after which they have by Degrees deflected it towards the Earth, from which it was then at a considerable Distance. The Root ascended at first, because as the Grain was inverted, the Juices of the Lobes necessarily forced the Root upwards; but when it began to receive its nutrimental Juices immediately from the Vapour which ascended from the Earth, this Vapour in Consequence of its Tendency aloft, flow'd into the Tube of the Root, and attracted it downwards to itself by the Continuation of its Action. I one Day accidentally left a few Grains of Corn upon my Standish; the Humidity of a Sponge which was there, wrapt round a little Vessel of Water, made the Corn which was under it shoot out; the Root, when it had sprouted forth a little, did not descend from the Side of the Standish, in order to continue its Progress to the Earth, but ascended between the Spunge and the Vessel, towards the Aperture from whence the Water flow'd into the Spunge, and at last reached the Fluid itself. Do you imagine this Root had any particular Inclination to that Part?

No

No certainly ; but the Vapour or Humidity which exhaled from the Sponge, and especially from the Aperture of the Vessel in its Descent, flowing into the Root, raised it in a Direction contrary to the Descent of the Vapour, and attracted it to itself. If then the Root of a Plant shoots down into the Earth, 'tis owing to the Impulse of the Sap, which produces this Effect.

Countess. This Explication is natural enough ; but as yet I don't comprehend how you can ascribe to the Impulse of the Air the upward Growth of the Stem, or that Disposition in most Plants to raise and sustain themselves aloft with that noble and Majestic Air that adorns all Nature.

Prior. When the two Seminal Leaves are once shot into the open Air, the whole Affair is accomplished ; if you strip them from the Stem, the Plant will soon die ; but if you permit them to grow, it will quickly rise and ascend in a strait Line. It rises soon, because the warm external Air flowing into the Orifices of the little Air-Pipes that open on the Surface of the Seminal Leaves, dilates the cold Air it meets with in the Stem and Root ; it extends the Spiral Rings of the Air-Tubes, and presses all about it. Those Particles
of

of this Air which escape into the Lobes, compress the Vessels there, and drain them of their Juices to enrich the Stem. The other Particles that flow into the Root, cause the Sap to ascend into the Body of the Plant, and are daily pouring it into new Vessels : These Vessels swell and sustain the Fibres, and at the same Time force them to ascend. The Bark enlarges, the Leaves open, and Vigour reigns through the whole. But with this Assistance of Air, the Stem not only rises soon, but likewise ascends in a strait Line, because the Impulse of the Air which flows into the Vents presented to it by the little Stem, has a Tendency upwards ; and as the external Air likewise encompasses all the Plant, and in its Descent equally insinuates itself into every Part of that Plant, equally dilates all its Air-Vessels, and equally fortifies all its Fibres : No Reason can be assigned why such a Plant should incline to one Side more than another, or at least some foreign Accident must intervene to bend the Stem. The Lobe and Seminal Leaves begin now to be useless to the Plant ; its own Foliage provides more availing Supplies by the Multitude of new Air-Vents which it unfolds, and through which the external Air, forcing into Motion

Motion that which it finds within, raises from the Roots a Quantity of new Juices that fill the Fibres, the Vessels and Pith, causing a vigorous Youth to succeed a delicate and feeble Infancy. The Juices which then ascend in the Plant, are too strong to be admitted into the tender Fibres of the Seminal Leaves; they find freer Passages elsewhere into which they flow. The small Quantity of Sap remaining in these Seminal Leaves, continues to discharge itself into the Stem, or else it evaporates without being recruited; by which Means, both the Seed and Seminal Leaves gradually wither or rot away.

As the Plant is now no longer in its Infancy, let us examine in what Manner it receives its Nourishment.

Count. I am no more in Pain to discover the Principle of Motion in the nutritional Juices, since the Air we breathe by the Mediation of a single Wind-pipe, and which is capable of imparting Motion to the Aliments, and Fluidity to the Blood, enters through a Number of Tubes into the Body of Trees and the very Depth of the Earth, where it descends to find out and convey proper Nourishment to Plants; and it is easy to comprehend how the Air, acted upon by the Sun's Heat, and expanding
by

by its natural Spring, can push before it, and impel into the Apertures of the Roots, what Juices it meets with; but my great Difficulty is to know how the Air and Heat are capable of conveying to each Plant, the very Juices that peculiarly correspond with its Nature.

Countess. This is what I was waiting to hear the *Prior* clear up. These Plants are fixed in the Earth by as many Fastenings as they have Roots: They cannot move one Step to provide for their Necessities. How can the heated Air furnish them precisely with what they want? For each Species has its particular Inclination and Taste. This must be supplied with acid, and that with sweet Salts; one demands Milk, another must be nourished with Oil: How then can they be all accommodated without any Mistake?

Prior. Should the Air indeed change its Operations, and convey a Flow of acid Juices to a Tree that requires Oil, a single Kitchen Garden would disgust a Number of People. But the Air and Heat have it only in Commission to give Motion to all the Juices they find, and direct them to the Plants, who are then to chuse for themselves whatever they want.

Cheva-

Chevalier. How, Sir! have Plants then Discernment enough to single out what is proper for them, and reject all that may prove injurious?

Prior. Discernment, Sir? You would not imagine to what a Degree of Nicety their Choice extends. But to make you sensible of it, let us compare the Earth of a Kitchen Garden, impregnated with its different Juices, to a Vessel in which Oil, Water and Wine have been promiscuously poured. Take three Linnen Fillets, and steep the End of one in Water, the End of the second in a few Drops of Oil, and that of the third in Wine; after which, dip these three Fillets into the Vessel in such a Manner that their moistened Extremities may plunge into the Liquor, and the Ends that are dry may be raised and brought over the Rim of the Vessel. The Fillet, which was first steep'd in Water, will fill itself with that Fluid and distill no other; that whose End was dipped in Oil, will distill Oil alone; and the other will redden by Degrees and distill no Liquor but Wine: They never vary in this Operation, and you will find something in Plants that perfectly resembles this Proceeding. That Being who created them, and by whom they are supplied with all the Vessels necessary

necessary to their Nourishment and Propagation, has not neglected to place, at the lower Extremity of these Vessels, a System of Strainers, whose different Perforations easily admit certain Juices and reject others. The proper Vessel seems more especially to have been impregnated towards its Extremity with some Drops of the Liquor that imparts a distinct Scent and Flavour to the Fruits of every Plant; by which Means, the Fibres permit only Water and certain Salts to flow into their Orifices, and the proper Vessel gives Admission to nothing but Oils perfectly conformable to the Nature of its own, whilst all others will be constantly excluded.

By the very same Process, the Sap of a wild Stock is refined at the Entrance into a good Branch that has been grafted on it. This Sap meets with Strainers, or the Orifices of Tubes, too fine to give Admission to its grosser Particles, and consequently none but the most delicate can pass through: At the Entrance into the proper Vessel it arrives at a System of Glands impregnated with a certain Oil: All the Particles of the Sap that correspond in Fineness with this Oil, are well received, the rest flow in a different Track, and are distributed into Branches where they may prove

The Refinement of the Sap in Graft.

more acceptable. And thus the same Tree is capable of producing Fruits very different in their Natures and Qualities.

Chevalier. I am lost in Astonishment at the View of so much Simplicity and Prolifickness at the same Time in the Works of the Deity.

Prior. We may conceive, at least in some Degree, how Plants of a different Nature may, in the same Earth, and without any Effort or Motion of their own, be supplied with Juices and Liquors necessary to their Welfare; and now, if possible, let us attempt to pursue these Fluids, in their Progress, and discover whether the Ascent of the Sap from the Root to the Branches, and its Return from the Branches to the Root be a Fact or not, and in what Channel it flows.

I am much inclined to believe that the Sap neither ascends through the Pith nor the Bark: It cannot rise through the Pith, because this is unprovided with Vessels proper to convey upwards, and is only furnished with little Cavities to contain it. In short, it is the common Reservoir of the Sap but not the Canal through which it flows. There is likewise as little Probability that it should mount through

the Fibres of the Bark, because the Sap which is found in the Bark of several Plants, as Cherry Trees for Instance, is tinged with a very beautiful Red, a Quality not imparted to it by the Earth, and which, indeed, it cannot acquire any otherwise than by the Intermixture of the Juices that descend from the Leaves and Fruits. It remains for us then to say, it ascends through the Fibres of the Wood itself, toward the Extremities of its whole Circumference; and indeed these long Fibres, so proper for the Conveyance of Fluids, are the very Vessels wherein we find the crude Sap without Colour or any other Quality, unless it be generally a very sharp Acid. It refines in its Progress through the Tubes, which in their Ascent contract themselves into lesser Dimensions, and allow a Passage only to light Juices and Salts. The Sap flows into the Leaves, where it acquires its Perfection, because a great Number of Air-Vents opening to the sky on the upper Surface of the Leaf, are perpetually receiving fresh Supplies of Air, and new Particles of Nitre, Fire, and salutary Spirits, which subtilize the Sap, and qualify it for Admission into Flowers and Fruits.

The Use
of the Fi-
bres of the
Wood.

The Use
of the
Leaves.

The first
Use of the
proper
Vessel.

The Ori-
gin of the
Scent and
Flavour of
Fruits and
Flowers.

It is likewise very credible, that the proper Vessel, as it shoots its Branches into all the Leaves, Flowers and Fruits diffuses into them a certain Honey or Oil that mingles its balsamic Particles with the Air, Salt, and Water; from whence the Scent and Flavour of Fruits and Flowers evidently result. This Observation agrees very well with Experience: No Parts of the Tree are more oily and shining than the Leaves and Flowers; and the Conformity of Taste between the Oil which moistens the Leaves, and the Fruit which is cover'd by them, is very sensibly perceived in several Trees, particularly those that bear the Walnut and the Peach. The Leaves have before-hand the agreeable Bitterness and Taste which they afterwards communicate to the Fruit and Kernel they are to produce. The Sap, purified and perfumed in the Leaves, acquires a Delicacy sufficient for its Admission into the Pedicles and Stems of the nearest Flowers or Fruits and this is the Track wherein, according to all Appearance, it flows, because when Caterpillars or other Accidents have strip'd the Trees of their Leaves in the Spring, the Fruits that begin to be formed, wither away; certainly for Want of Sap, the Mildness of the Season

Season furnishing them with a sufficient Quantity, but only for want of a Sap prepared and accommodated to the Vessels that compose these Fruits.

The Sap, whose Grossness made it incapable of a Reception in the Capillary Vessels of Leaves and Fruits, apparently discharges itself into the Bark. The Return of the Sap.

That Sap, the Fineness of whose Juices gave it Admission into the Leaves and Fruits, after it has passed through the Fibres, the Utricoli or little horizontal Vessels and the Pith, divides itself into two Branches, one of which flows back through the Bark, and the other evaporates, by Transpiration, through the Epidermis or fine Skin.

The refined Sap, which flows back through the Bark, colours the grosser Sap which likewise repasses there; and the Mixture of these two Fluids produces that admirable Effect in the Bark, which his Lordship made us acquainted with before, I mean the detaching and Nourishment of the last Round of Fibres of this Bark, in order to incorporate it into the Wood, and enrich it with a new Circumference. But this is not the only Function of the Sap which descends into the Bark: Its finest Particles are received into the Utricoli, and those which are too gross, are

precipitated towards the Root, in order to be raised and filtered anew.

The Juices which are received into the Utriculi, flow horizontally cross the Fibres of the Wood to the Pith, where they perform two Functions : First, they refresh and nourish the Wood through its whole Length ; and secondly, they pass from the Pith into the transverse Fibres that form the Knots ; by which Means, the Gems lodged there are impregnated with a Juice prepared and adapted to their delicate Structure ; and if you top a Tree, the Pith, as it then receives a greater Quantity of Sap, shoots out more Gems. This Progress that I ascribe to the Sap from the Bark, from thence to the Utriculi, from these to the Pith, and from this through the Fibres of the Knots, is exactly conformable to the Disposition of the Vessels ; and the more probable, because Plants which have many Gems, Flowers and Fruits, are likewise furnished with a abundance of Pith, as the Elder, for Instance ; and, on the contrary, those that have but few or no Gems to nourish are quite destitute of Pith ; of this Sort are the Stalks of Beans and Blades of Corn.

As to the other Part of the refin'd Sap, which evaporates through the Epidermis

dermis or fine Skin of the Leaves and Fruits, it only transpires in Proportion to the Orifices of the Pores. A gentle Heat, qualified with soft and refreshing Gales, keeps all the Juices of Plants in Action, and prevents an immoderate Evaporation: 'Tis this which preserves ^{The two} the great Quantity of Sap they possess ^{Saps.} both in Spring and the Close of Summer. But the Heat is sometimes so violent, and opens the Surface of the Leaves and other Parts of the Plant to such a Degree, that the Juice of the Utricoli, which runs horizontally to the Epidermis or fine Skin, soon flows out and dissipates. The Utricoli then lose more Sap than is restored to them, and consequently must shrink and flatten like empty Bags; the Fibres which they sustain languish and fade for want of that Support, and you then see the Leaves and little Branches hang down as if they were ready to wither. Whilst the excessive Heats continue, the Tree thrives more by Night than in the Day, because the Night supplies the Tree with more Juices than the Day had evaporated.

But, besides the Freshness of the ^{The Se-} Night, Nature has prepared for this ^{cond Use} Evil another Remedy, which is always ^{of the pro-} practicable even in the ordinary Heats. ^{per Vessel.}

The proper Vessel, which contains a gummy Fluid peculiar to every Plant, is not only design'd to compleat the Sap and Flavour of Fruits, to perfume the Air with the most fragrant Odours, to paint the Flowers and Fruits with the amiable Glow we so much admire, to furnish the Bees with the Syrup they extract, and to accommodate Mankind with salutary Oils of every Sort ; besides all these Effects it has another Function, it diffuses over the Leaves a small Quantity of its Oil the light Flow of which, though it cannot prevent the violent Infusion of Air into the Vent-Holes, is sufficient to cover and close up the other little Orifices of the Epidermis and Sap-Vessel which preserves the Juices from too great a Diffipation.

Ever-
Greens.

From hence it apparently follows that Plants abounding with this Oil which in them is more viscous and difficult to be evaporated, must be always green, such as Box, Laurel, Orange Trees, and especially Pines, Firs, and Yews, which spread their Verdure in Regions exposed to the severest Cold and most neglected by the Sun. These Trees are slow in their Growth, because they admit less Air than others, because they retain better what they enjoy, because the Oil or Rosin, with which the

they are impregnated, defends their outward Surface, and prevents Heats, Rains, and sultry Winds from dissipating their Juices and impairing their Growth.

The Fall
of the
Leaves.

When the Rains and Winds in Autumn have washed the Oil from the Leaves and their Stems, and the Atmosphere, condensed by the Cold, renders the lower Air less flexible and active in Plants; the Juices which then evaporate without Opposition, being no longer recruited, the Sap-Vessels are exhausted, the Leaves with their Fluids lose their Colour and Weight, the Wind snaps their wither'd Stems, and bears them away, and the Winter benums all Nature who is then indolent and disarray'd, and Death seems to reign in every Part, till the returning Sun diffuses new Life, by re-animating the Air and the Sap.

Count. There are two Points in your Supposition which may be separately consider'd: One is the Manner in which you represent the Circulation of the Sap; the other, is the Cause to which you ascribe this Circulation. I am furnished with some Proofs that seem expressly calculated to justify both Particulars: As to the first, take these following.

In * *Languedoc*, when they graft the Olive-Trees in the Month of *May*, they

* *Histoire de l'Acad. des Scienc.* 1709.

cut

cut the Bark in a circular Line, and the Breadth of three Fingers above the Graft, so that the Wood of the Trunk or large Branch becomes visible in that Part. Now if your Conjecture be just, the nutrimental Juice must always ascend through the Fibres of the Wood toward the Extremities, and as it afterwards descends through the Bark, it must arrive at the circular Gash, where a small Quantity of the Juice will, for a little Time, flow through the Wound, and then dry into a Consistence in the open Air, forming by Degrees a hard Tumour which closes up the Passages. The Sap, in its Return through the Bark, being intercepted by this Tumour, must always flow more and more into the Branches, and this Abundance will discover itself by a greater Profusion of Leaves, and even an extraordinary Bloom of Fruit. But as only a very small Quantity of the Sap can be evacuated through the Oil that moistens the Surface of the Leaves, this Sap, for want of a free Discharge, may increase to such a Degree as intirely to condense and stagnate, and be incapable of flowing either up or down; which inevitably kills the Branches. As the Sap has no longer any Passage, the Juices in the Leaf-Vessels will dissipate

sipate

sipate by Degrees ; these Vessels then being empty and flat, will deprive the Ribs and Stems of the Leaves of all their Tension, and the Whole will at last languish and die. This is what happens in particular to the Olive-Trees I am speaking of ; they produce that Year double their usual Quantity of Leaves and Fruits : After which all these Branches, (I mean those which are above the circular Wound in the Bark) die the same Year. The Country People had rather suffer the old Wood to perish in this Manner, than cut it off at first above the Graft ; because, by these Means, they gain a more considerable Profit.

I know some Plants, very tender and full of Milk, which afford Circumstances that may confirm your Opinion : When you bind them very tight about the Middle of the Stem, you see, by Degrees, all above the Ligament swell and appear ready to burst, which can only proceed from the milky Juice which rises from the Root through the Body of the Stem towards the Top, and afterwards descends along the Bark, and would continue its Progress to the Root, were it not stopp'd by the Binding, in the same Manner as the Blood flows from the interior Vessels

The Milk
Thistle.

Vessels or Arteries through secret Ducts into the exterior Vessels called the Veins, and from thence returns to the Heart, unless you obstruct its Course by a Ligament; after which it increases in Quantity, and visibly swells the Vessels.

Palm
Wine.

'Tis very well known, that the *Indians*, by making an Incision at the Bottom of the Bark of their Palm or Date Trees, and thrusting in a little Reed, extract a very agreeable Liquor in great Plenty, which they call Palm Wine; and which, in a few Days, changes to Vinegar. In my Judgment, we need only suppose the Return of the Sap through the Bark, to account for this Fact. How could the Sap, in rising from the Earth through the Bark, as is commonly imagined, acquire that aromack or viscous Flavour? It is much more natural to say, that this Sap ascends through the Fibres of the Wood, filters and refines itself to its Perfection in the Leaves, and there mingles with the Liquor of the Vessel proper and peculiar to the Palm-Tree; after which, that Part of the Juice which flows back from the Leaves, mixing itself in the Bark with the Fluid that descends from the Branches, produces a copious and agreeable Liquor,

quor. At the Expiration of a few Days, the volatile and pleasant Juices which in that Liquor corrected the Acrimony of the Salts and the bitter Flavour of the crude Sap, being evaporated, the *Indians* have then nothing but a gross Sap in which the Salts are unsheathed, and this makes their Vinegar.

In a Word, Sir, our Manner of Grafting furnishes me with a very good Proof of the Justness of your Thoughts on the Progress of Sap. The two most usual Manners of Grafting, are those we call Grafting in a Cleft, and Grafting by a Scutcheon: The former consists in topping a Tree or Branch, cutting a Cleft in the Substance of the Wood, and carefully inserting the End of a little Branch of a kind Nature: The latter consists in making a small Wound in the Bark, and insinuating between the Bark and Wood, a Knot or First-sprouting of a Branch of a kindly Nature, accompanied with its Bark. In your System, according to which the Sap descends in the Bark, by flowing back from the Extremities of the Branches and Leaves, the Graft, by a Scutcheon, is very advantageously situated; because, as it is fixed between the Bark and the Wood, where the Sap has its most plentiful Flow, it is copiously

ously supplied with all the Juice it wants, and discharges, without Obstruction, all that is superfluous; for which Reason, Grafts of this Sort succeed very well. But the Case is something different with Respect to Grafting by a Cleft, for if the little Scion be not inserted into the Wound in such a Manner that its Bark perfectly corresponds, at least on one Side, to the Bark of the wild Stock, it may appear well at first, because it derives a sufficient Quantity of Sap from the Fibres of the Wood, but when these Fibres come to be in Action, and begin to fill the Cleft, then the Return of the Sap into the Bark of the Graft will be obstructed by the contrary Flow of the Sap which rises from the Fibres of the wild Stock, so that the Graft having no longer any Discharge, must necessarily perish; whereas, if its Bark be exactly joined to that of the Stock, it will draw the Sap from the Fibres, and return it in full Freedom through the Bark. If it be asserted, that the Sap takes any other Progress than what you have assign'd it, I don't know how these usual Operations can be accounted for.

As to the Cause of the Circulation, which you ascribe to the Action of Heat

Heat and the Spring of the Air, the Proofs are very numerous. Plants are so subject to the Impulse of the Air, that they faithfully submit to all its Variations: They die when they are destitute of Air; they languish when they have but little; they are benum'd when it is condensed, and re-animated when it recovers its Vigour.

I lately made an Experiment, which is so favourable to your Opinion, that it would be Injustice to conceal it from you. * I sow'd some Lettice Seed in Earth exposed to the Air; and at the same Time sow'd a few more of that Seed in Earth which I placed under the Receiver of an Air-Pump, and immediately drew out all the Air. The first Parcel of Seed sprouted forth, and, in the Space of eight Days, shot up an Inch and an half high; but that which was in the Receiver, did not spring up in the least: I then let the Air into the Receiver, and immediately every Thing was in Motion, and in less than eight Days the Seed shot up to the Height of two Inches and more.

It is likewise owing to the Power of the Air, that the sprouted Barley, which is brewed for my Servants, and usually

* Philosophic Transactions, n. 23. Lowthorp's Abridgement. Vol. II. p. 845.

kept in a Cellar, turns and directs all its Shoots to the Opening through which the Air flows. The Air, which enters at that Passage, streams into the Pores of all the Grain, and turns them to that Quarter, which is a Confirmation of your Remarks on the Tendency of Plants.

The same Tendency is observable in all Plants that are laid in Cellars, their Leaves are always directed to the Air-Vent or the Door.

In a Word, so true it is that Plants are only strong or weak in proportion to the Force or Imbecility of the Air which insinuates itself into their Pores; that if you expose Succory, Cardoons and Selery in the open Air, they will be tinged with a very strong Green, but the Flavour of their Juices will be too bitter; whereas if you bind them with a String, or lay them up in Bundles, as the Air will then no longer penetrate their Vents, so hardly any Nourishment can pass through their Surfaces: But a Remainder of Air, which still operates under the Earth, and finds no free Passage but towards the Heart of the Plants, will direct to that Part an inconsiderable Quantity of weak Juices, proportioned to the Smallness of the Fibres. All those
sprout-





sprouting Leaves you discover in the Inside of these Bundles, advance slowly, and, as they are incapable of enlarging their Fibres, they always preserve an Air of Delicacy and Youth; every Part is tender, the Flavour agreeable, and the Colour extremely pale.

Chevalier. I have sometimes asked the Reason of this of our Gardiner; who made me no other Answer, but that it was his Business to tie the Succory into Bundles, and mine to find out the Cause of their whitish Complexion.

Count. If the Air fortifies and unfolds Plants in Proportion as they are susceptible of its Power, we have then the Solution of a Question that has frequently employed our Thoughts, though we could not determine any thing particular. Look on that lit-

tle Hill, *Chevalier*, it ends in a very level plain, on which you observe a large Walnut Tree, and likewise another on the Slope of the Hill: Be pleased to take Notice, that the lowest Branches of the Tree which grows on the Plain, are exactly Parallel to the Earth over which they spread, and every where at an equal Distance from it. Observe likewise, that the lowest Branches of the other Tree on the Slope of the Hill, are all at an equal Distance

Why the lower Branches of Trees are parallel to the Earth on which they are planted.

P

from

from the Earth; but the Tree, to acquire that Arrangement, has shot out a much greater Number of Branches towards the Bottom of the Hill than towards the Top. You will constantly observe, that the lowest Spread of Branches of those Trees which are permitted to have their natural Growth, will correspond with the Position of the Earth they cover, and describe an oblique or horizontal Line to preserve, in every Part, an Equidistance from the Earth. If the Reason of this kind of Tendency be demanded, I think it is to be discovered in the *Prior's* Conjecture, and flows from it as a natural Consequence.

The Trunk of the Walnut Tree on the Declivity of the Hill, forms an acute Angle with that Hill towards the Top, and the same Trunk makes an obtuse Angle with that Hill towards the Bottom; or, in other Words, there is much less Space between the Tree and the Earth of the upper Part of the Hill, than there is between the same Tree and the Hill towards the Bottom. If therefore there be six Columns of Air between the Tree and the Earth towards the Summit, or in the acute Angle, there will be nine or ten Columns towards the Bottom, or in the obtuse

obtuse Angle : Now, where an equal Quantity of free and active Air is diffused, there very near an equal Growth of Branches will spread ; and on the contrary, where the Air has a stronger Impulse, there a greater Number of Buds and Branches will spring forth. On each Side of the Tree that grows on the level Plain, you see an equal Distance between each Side of the Top of the Trunk and the Earth ; these are two Right Angles : On both Sides there is an equal Impression of Air, and consequently you observe, both on the one and the other, almost an equal Quantity of Branches ; and as those on the right Side fill a Space equal to that on the left, the whole Base is therefore very near parallel to the Horizon, and almost equidistant from the Earth in every Part. For the same Reason, if the Walnut Tree on the Slope of the Hill, shoots forth Six hundred Buds on the upper Side, by Virtue of the Impulse of six Columns of Air, it must necessarily unfold a thousand Buds on the lower Side by the Impression of ten Columns : And this Side undoubtedly producing more Buds, the Branches that are their Offspring will possess more Space than those above, and therefore, shooting into a proportionable

onable Extent, they will approach as near to the Earth as those on the upper Side; and consequently 'tis altogether as natural for the Base of those Branches that grow on a Slope to correspond with the Obliquity of that Slope, as it is for the Base of such Branches as grow on a Level, to be as even and horizontal as the Soil itself.

Prior. The more simple the Consequences are, and the more natural the Applications that result from our Conjecture, the more readily it will be received. You see, *Chevalier*, two dead Trees at the Entrance into the Orchard: Perhaps what we have advanced will enable us to guess at the Cause of their Distemper and Death. One of these Trees is intirely cover'd with Moss, which is a Plant that grows on Trees, and shoots out a prodigious Number of little Roots and Branches: The other Tree was full of a Gum that is extravasated and shed over the Leaves as well as the Bark. What Injury can Trees recives from the too great Abundance of Moss and Gum?

The Effects of Moss and Gum.

Chevalier. 'Tis evident that the little Roots and Branches of Moss, by covering the Tree almost from Top to Bottom, have closed all the Air-Vessels.

fels, by which means the Tree is incapable of Respiration: When the Air ceases to operate upon it, no more Sap is to be expected.

Countess. 'Tis altogether as plain then, that an excessive Quantity of Gum, closing the Air-Vessels of the other Tree, has produced the same Effect as the Moss, and perhaps the Injury might have been prevented at first, by stripping off the Moss and washing away the Gum.

Prior. If the little we know of the Use and Correspondence of the inward Parts of Plants be sufficient to fill us with Admiration, what will our Astonishment be, when we come to consider their Fecundity! Their Roots, their Stem, all the smallest Branches, the Generality of their Flowers, and all their Seeds, are impregnated with Buds without Number. A single Tree, a single Branch, nay, a single Seed, is sufficient to communicate a Species to the whole Earth, through the Succession of all Ages. This Fecundity has the Air of a perfect Prodigy, and if we ought to be affected at the Excellence of the Gifts we receive from the Deity, I think the Profusion with which he bestows them should give us the same Impressions. He has not only been

P 3

pleased

pleased to give us the Possession of this or that beneficial Plant, but has likewise will'd and preordain'd, that Mankind shall never be destitute of them, whatever Accident may happen.

Countess. Not long ago we had the Company of a Gentleman of excellent Understanding, who attempted to count the Seeds in one of the Branches of a young Elm, that had been planted twelve Years, and forming a Judgment of eight other principal Branches, by what he discovered in this; and computing the Produce of an hundred Years by that of twelve, his Calculation amounted to Millions and Myriads of Millions of Seeds*. He likewise counted all the Buds that were visible, and in a Condition to produce new Branches in one Year; and then adding them to those that would be the Product of a Century, and at the same Time including such as at present remain'd useless in every Part of the Tree, for want of the necessary Preparations for their sprouting forth, he made a Computation which perfectly astonished us; and very judiciously concluded, that not only the Marks of Wisdom and Power, but, if we may presume on the Ex-

* Memoires de l'Acad. des Scienc. M. Dodart 1700. and Nieuwentyt hist.

pression,

pression, the Traces of Infinity itself were impressed on all the Works of the Deity.

Prior. These Truths are worthy of our highest Admiration and Reverence. They astonish us, because our Faculties are limited ; but it is good to have an imperfect View of them, that we may be sensible of our own Insufficiency ; and where do we not meet with Opportunities for such a Conviction? 'Tis not only the immense Number of Seeds in a Plant that confounds our Imagination, a single Flower, even in its visible Exterior, and which we behold opening in a Morning and fading at Night, presents us with the Traces of a Wisdom to which neither our Eyes nor Reason are capable of attaining. It was the Deity's express Intention to over-whelm us with this Species of Infinity that unfolds itself in all his Works, and even in the minutest Creatures, to keep our Understandings in Subjection to that Infinity that shines in his Essence, his Attributes, his Providence, his Operations and Mysteries.

Countess. It is very certain that a Flower which seems such a common Object, comprehends not only Beauties, but even Advantages and admirable Designs. I always considered a Flower

as a Work in Miniature, created to entertain the Eye with amiable Colours, and sometimes to refresh the Smell with fragrant Exhalations, and that was the Utmost of my Conception: But my Calculator surpris'd me exceedingly, when he acquainted me that the Flower was not only the Sheath and Covering of the Fruit, but that even every Part of the Flower was necessary in order to give the Fruit its Formation and Shape; and I shall never forget his * ingenious Explanation of all these Particulars. We Women, who have seldom the Advantages of any great Instruction, are sometimes much more astonish'd than your Sex at a new Discovery, and easily retain it, because we are not subject to the Confusion that a Number of Sciences might occasion.

There are some Flowers, said the Gentleman of whom I am speaking, that are folded up in a large and common Covering, such for Instance as Poppies and Carnations: There are others that have none, and these are Tulips, Anemonies and several more. But all Flowers, or at least the greatest Number, have Leaves, Pistils, Tops, and

* Samuel Morland transact. phil. n. 287. Ray's Hist. of Plants. Memoir. de l'Acad. des Sc. M. Geoffroi le jeune. 1711.

Chieves. The Leaves are a kind of ^{The} Pallifado, with which Nature has en- ^{Leaves of} compassed the Heart of the Flower, ^{a Flower.} to cover it as there may be Occasion. These Flowers open at the rising of the Sun to receive the Heat; and close up, some more, others less, at the Approach of Rain or Night, to keep off Moisture and Cold. For the most Part they form a little Vault which incloses the Seeds, and seem, with a kind of Conscioufness, to preserve the Grains consigned to their Care*. These Grains or Seeds are usually shut up either in one or several Pistils, which are so ma- ^{The Pistil.} ny Shells or Bags placed in the Center of the Flower. The Chieves are ^{The} Fibres or little Pillars which rise to ^{Chieves.} the Heighth of the Pistils, and sustain the Tops; and these Tops are a Kind ^{The} of Pendants or hollow Shells filled, when ^{Tops.} they are ripe, with a fine Powder of the Nature of Rosin: They let this Powder fall through different Strainers into the Cup of the Flower, and particularly on the upper Part of the Pistil, which is shagged with Points, and covered with a gummy Juice, as well as pierced with little Holes, that it may the better receive and detain the Pow-

* Perhaps they are the same to Fruits, as the Seminal Leaves are to a young Plant.

der. The Points and the Oil stop the Grains of this Powder, and the Openings facilitate the Passage to the Seed; and so exceedingly small are these Passages, that one of them is intirely fill'd with a single Grain of the Powder; and if two should pass together, and be admitted into the little Orifice of the Bag that enfolds the Seed, it would introduce a Disorder, and be something monstrous in Nature. It is even very probable that these Grains of Powder are themselves little Bags of Wax that contain the real Bud: This Bud slides into the Pistil through the Opening in the Bag which remains without, where

The Seed. it is gathered by the Bees. The Seed, when it is warmed, pierces the upper Part of the little Skin in which it is inclosed; it receives a Bud, and opens itself for no more than one; all the rest, after that, are insignificant. This little Bud remains in the Entrance or Point of the Seed, and is an entire Tree that will unfold itself in the due Season. The Seed had no Fertility in itself, and is only the Nursery of the Bud: And so true it is that it receives this Bud from another Quarter, that should one pluck off the Chieves and their Tops as soon as the Flower begins to open, that Flower indeed would appear

appear as beautiful as usual, and the Seeds might have a little Growth, but notwithstanding that, they would still be unfruitful and no Bud would be there discover'd. These are a Set of Facts that sufficiently prove the Office and Use of the different Parts of a Flower. If immoderate Rains in the Spring should wash away this Powder, no Produce can be expected. When the proper Season for the Flower proves unequal, and either the Rain bears away the Buds, or the Cold shuts up the Orifices of the Caskets that contain the Seeds, as few or none of the Buds enter into these Caskets or Pistils, the greatest Part of the Seeds continues barren, and the Product is inconsiderable. What I now tell you, is equally true with Respect to the Flower of the Vine and Corn, as it is with Respect to those of Trees and the smallest Plants. But when the Season proves favourable, and only one Grain of the Powder well ripen'd should fall into the Orifice of each particular Seed, these all become fruitful, and the Year is attended with Plenty. The other Grains of this Duct, which are innumerable, are not lost, for they furnish the Bees with their Wax, and a Number of Insects resort to them for their Food or other Conveniencies unknown to us.

But

But the *Chevalier* will have the best Idea of all these Things in the Spring of the Year.

The
Tulep.

In the Tulep, for Instance, which rears its Cup into the Air, the Chieves rise higher than the Pistil, that the Tops may Powder it, either by letting fall or suffering the Wind to blow their little Dust upon it : On the contrary,

The Im-
perial
Lilly.
The com-
mon Lilly.
The Ho-
ney-fuc-
kle.

with Respect to the Imperial Lilly, whose Cup turns downwards ; and the common Lilly and the Honey-fuckle, whose Flowers bend extremely, should the Pistil be shorter than the Chieves, 'tis evident that the Powder would fall from the Tops to the Earth, and be intirely usefess to the Seed inclosed in the Pistil ; whereas, if the bent Pistil be longer than the Chieves, the Dust, in that Case, in its fall from the Tops, will meet with the Extremity of the Pistil, and enter into it without any Difficulty ; and this is Nature's Arrangement of the Flowers ?

The Sun-
Flower.

Chevalier. Here is a Sun-Flower, Madam, will your Ladyship oblige me with a Sight of the Particulars you have been describing ?

Countess. With a great deal of Pleasure, Sir. 'Tis a Flower that deserves some Attention, and I have lately observed a Structure in it very different from that of other Flowers : It contains

tains as many Pistils as Seeds, let us take some off with a Needle. These white Seeds, which I take from the Bottom of the Flower, have no Fertility of their own. Above each particular Seed a little Cup rises, in the Middle of which is a Kind of Bag of a brown Colour, and full of a yellow Powder: Each of these Bags performs the Office of a Chieve and Top to the Seed which is beneath. Through the Bag rises a little Tube, whose Bottom joins to the Seed, and its Top is shagged with Hair for the Preservation of the Powder: This Tube likewise opens at the Top to give a Passage to some of the Buds, and splits into two Points: When it has performed its Office, the Points rise and fold over one another; after which, they become dry and useless.

Some Plants have no other Flowers ^{The Fig Tree.} than their own Fruit, as the Fig-Tree, where all the Kernels that are in the Fig are charged and accompanied with their Chieves, their Tops, and their Powder.

There are other Plants on which we ^{The} discover two Sorts of Flowers separated ^{Pompion.} on the same Stem, as Pumpions and ^{The} Melons. ^{Melon.} Gardiners give the Name of real Flowers to those which contain the

the Fruit, and call those false which inclose their Powder in a Bag placed in the Middle of the Flower, and out of which this Powder escapes through three or four remarkable Openings. The Gardiners generally pick off these pretended Flowers, which is a very good Method when their Produce is certain, and the Melons compleatly formed, because they husband the Sap by this Retrenchment; but they deceive themselves extremely when they destroy these false Flowers at their first Appearance, because they contain the genial Powders, without which, the other Flowers that produce the Fruit are incapable of any Fertility; and we had once a Gardiner, who, by an improper Officiousness in plucking off these false Flowers, deprived us of all the Fruit.

The Gentleman from whom I had all these Particulars, gave me an Opportunity of observing, that several other Plants, as well as the Pompion, had two Sorts of Flowers on the same Stalk; and during his Continuance here, made us sensible of the Truth of his Observations, which we found to be fact with Respect to the Oak, the Filbert-Tree, the Ivy, the Mulberry and Plane-Trees.

He

He afterwards informed us, that other Plants bore the Fruit-Flowers on one Stem, and the Flowers out of which the Pistils spring, on another, of which Sort are the Palm-Tree, the Hop, and several others.

Chevalier. All that her Ladyship has related charms me with Admirati-
on ; but I find it difficult to compre-
hend how the Seeds should be on one
Stem and the Flowers or Powder on
another.

Countess. This is what I see daily,
therefore don't be incredulous, *Cheva-*
lier.

Chevalier. Why then do they make
a Jest of those People who say Plants
are Male and Female ?

Plants
Male and
Female.

Countess. Let us take a Walk over
the Bridge to those People who have
been gathering Hemp, a single Instance
will make you believe all the rest.
Here are two Sorts of Hemp exposed
to the Sun ; in one of which you see
the Flowers are dried, and it is that
which has been gathered for some Time ;
the other is still green, and there you
see several Bunches of Seed under the
Leaves. The Stalk which produced
the Flower was the tallest at first, that
the Powder which fell from the Flowers
might be received by the Seeds, which
were

were then lodged much lower on the other Species. The Flower-Stems having performed their Functions, began to wither, and they have been gathered and separated from the others, to keep the People employed till the Produce of the other was compleated.

Chevalier. Madam, I acknowledge myself a Convert.

Countess. Pray let me know which of these two Species you would call the Male, and which the Female ?

Chevalier. I should call the Male, that Growth of Hemp which produces the Flowers, and is at present much shorter than the other, and dries first; and I should give the Name of Female to that which bears the Seeds; and surely that must be the Fact.

Countess. I find you would place Things in a right Order, and give them their proper Names. But for all this, the Country People have thought fit to give the Name of Female to the Hemp which produces the Flowers, and is soonest dry; and they call that the Male which bears the Seed, and for no other Reason but because the Thread they spin from the first Growth is finer, and the other more compact and strong. When you are in their Company, you must talk like them, or else they

they will never understand you : But a Philosopher, or, in other Words, the *Chevalier* is at liberty to think differently from the Vulgar.

Chevalier. Your Ladyship will see what a Philosopher I am : I have not the least Knowledge of the Use of this Plant, and don't discover any Similitude between the Hemp in these Fields, and that which I have seen spun and work'd into Cloth : Will your Ladyship be pleas'd to explain this to me ?

Countess. I invite these Gentlemen to entertain the *Chevalier* To-morrow with the most curious Plants they have any Knowledge of ; for amongst such a vast Number they ought to fix on Particulars : And I dare say they will search all *Asia* and *America* for every Thing that is singular and uncommon. For my Part, I don't intend to wander far from my own Garden, though I may happen to present you with something more extraordinary than any of those that Foreigners boast of the most, and it shall be nothing but Hemp : This I reserve for my Subject, and our Conversation To-morrow will turn once more on Distaffs.

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PLANTS.



PLANTS.



DIALOGUE XV.

The COUNT *the* COUNTESS,
The PRIOR *and the* CHEVALIER.

Countess.  HEVALIER, it is not any Compliment, when I assure you that the sudden

Notice of your Departure gives me a real Concern. The new Alliance in your Family is a very advantageous Affair, and I am sensible it is absolutely necessary for you to assist at the Ceremony; but I flatter'd myself with the Pleasure of your Company till the End of *September*, and now all our Schemes are

are disconcerted : Adieu to Fishing, Hunting, and the new Academy.

Chevalier. The last Article gives me the greatest Pain. One may be entertain'd with Hunting and Fishing in every Place, but I can no where enjoy such Conversation.——

Count. Ah, *Chevalier* ! we are indulging the ceremonious Strain. We must banish all that from our Academy.

Countess. Very well. Your Lordship makes Regulations when the Academy is at an End.

Count. At an End ! I rather take it to be only in its first Establishment, and that our Assembly will be renewed every Year in *September*. Is not this your Opinion, *Chevalier* ?

Chevalier. I am only apprehensive of one Inconvenience ; and that is, I shall be wishing Eleven Months for *September*.

Count. Your Disposition is so well known to me, that I am persuaded you will do every Thing with Elegance and Taste. That polite Literature, to which you are going to devote your Attention, is altogether as entertaining and useful as natural History, which at present is not so necessary for you to be instructed in ; and I only re-

commend it as an Amusement to you in your Vacations. But, whilst we are in Expectation of your Return, the *Prior* and my self will sketch out the Subjects of our future Entertainments: I leave the Choice intirely to him, and we may very well depend on his Judgment.

Chevalier. How happy are we in the Country! and indeed we might be so in Town could we enjoy ---

Prior. Let us be more conformable to the Laws of our Society. No Compliments I intreat you. Academicks, like ourselves, never meet to admire one another. We come here to be entertain'd with what her Ladyship promised Yesterday.

Countess. You must allow the *Chevalier* to give you a small Instance of his obliging Temper, since you are under no necessity of being in much Hurry for the Amusement I promised you; for, in short, it is nothing more than Thread and Hemp.

Prior. We don't think the Subject at all trivial; and whatever is useful to us, is more necessary to be known than any Thing that passes in *Jupiter* or the Moon. The most shining Speculations, and the Choice of Subjects intirely foreign to us, are not attended with

with the most profitable Consequences. And I am better pleased with * Monsieur *Reaumur*, when he is contriving to destroy the Moths in our Tapestry, and the Vermin in our Houses, with Oil of Turpentine and the Smoak of Tobacco, than I am with Monsieur *Bernoulli* wrapped up in his Algebra, or Monsieur *Lebnitz*, combining the Benefits and Inconveniences of possible Worlds. Must we always be a thousand Leagues from the rest of our fellow Creatures, in order to be rational and learned? For my Part, I think, on the contrary, that a Philosopher cannot make himself too obvious to Mankind, or employ himself in any Thing better, than getting a right Apprehension of those Objects that surround him, and in which he has any particular Interest.

Countess. It is diverting enough in the *Prior* to rank me among the Philo-^{Flax and Hemp.}sophers, and make what I have to say on Hemp pass for Philosophy, when my Observations are taken from the Peasants, who in these Particulars, are our Masters: However, I'll undertake the Province, but must desire you to remember that this is the Philosophy of a Vacation.

* Memoir de l'Acad de Scienc. 1728.

Flax may be ranked in the same Class with Hemp ; and though it be much shorter and abundantly finer, it is a Plant pretty much of the same Nature, and employed in more beautiful Manufactures. When the Hemp and Flax have been gathered, which is done by plucking them from the Earth, the Stalks are exposed to the Sun, in order to ripen the Seeds, which are afterwards threshed out of the Heads, and then the Stalks are tied up in Bundles and steep'd in a standing Water (the clearest is always the best :) They are fasten'd to Poles and left to soak in the Water about fifteen Days. When the Substance of the Stalks is almost rotten, the Bundles are taken out and well dried. But instead of steeping the Flax in a standing Water, it is usually exposed to the moist Air of the Night, and the Heat of the Sun alternately, by which it receives a finer Colour. When the Flax and Hemp are well penetrated, and afterwards compleatly dried, they are bruised by handfulls on a Block with a kind of Mallet; all the Bullen, which is the Wood or inward Substance of the Stem, flies off in Shivers by the Force of the Blows, and nothing remains in the Hand of the Beater, but the thin Bark disengaged

gaged in large Threads through the whole Length of the Stem. This Parcel of Threads is afterwards hung on a perpendicular Board, and beat with a wooden Beetle, in order to shake out all the little Straws that may happen to remain in the Bullen. All the gross Parts are now seperated from the Stem, and the Threads of the Bark that remain in the Hand of the Manufacturer are intirely pure, and receive their Perfection from the Comb; or, in other Words, they are drawn first through large Cards or Iron Teeth, and afterwards through others that are finer, that they may be purified from whatever may be still too thick and gross. This Refuse is what they call Tow, of which Matches for the Artillery are made, and likewise a thick Yarn for Packing Cloths, whose Usefulness is infinite, since they wrap up and preserve the most valuable Commodities in their Transportation from one Country to another.

When the Hemp has been thus prepared, it is tied up in Bundles, to be sent to the Rope-yards; but if it prove fine and fit for the Spinster and Weaver, it is form'd into Twists; and now we come at last to the Distaff and Spindle. You smile, Gentlemen, but I shall

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make

make you sensible of the Value of what you so much despise. Suppose only for a Moment that you were three *Americans*, three *Iroquois*, or, if you think fit, three *Chineses*, no matter which, be so good as not to be offended at the Supposition. What would your Astonishment be were I to inform you that our *Europe* produces a little Plant, whose Fruit is an excellent Nourishment to several Birds, affords a kind of Bread which is good to fatten large Cattle, and produces an Oil that gives Light to innumerable Families; that instead of the Men, the *European* Women generally work off the Bark of this Plant, and manufacture it into those great Sails, by the Aid of which our Ships transport our Merchandize to the remotest Parts of the World, and convey to us whatever we want; that the same Bark is work'd into Cables strong enough to bear the Weight and Force of Anchors, and that Ropes, Packthread and Girths are likewise made of it; that all these are of constant and universal Use in Navigation, Commerce, Husbandry, and domestic Affairs: That with this very Bark Houses are made to shelter our Soldiers; that it likewise affords us the finest Ornament for our Tables; that we also make it into

a

a Dress that accommodates us Day and Night; is perfectly neat and convenient, and contributes as much to the Health of our Bodies as the *Bath*, to which it now succeeds, and from the Trouble and Preparation of which it entirely discharges us: In a word, that this Bark, according to the different Forms given it by the *Europeans*, becomes the most ornamental Habit of Kings, and furnishes the Husbandman and Shepherd with a Dress at a very inconsiderable Expence? These are the Benefits we receive from this Plant.

Well then, don't you Gentlemen of the new World believe us very happy in ours, to have Women who are so dextrous at the Spindle and Distaff, and are capable of fashioning this precious Bark?

Prior. For my Part, Madam, I, in the Character of a good *Iroquois*, shall maintain the Honour of our *America*.

You boast of your Hemp, and I allow it to be something: But we have three Trees that are at least as good as yours;

one creeps on the Earth like a Vine; the second is thick like a bushy Dwarf-Tree; and the third is as tall as an Oak: All the three, after they have produced very beautiful Flowers, are loaded with a Fruit as large as a Walnut, and whose outward Coat is intirely

Three
Sorts of
Cotton
Trees.

ly

ly black. This Fruit, when it is fully ripe, opens and discovers a Down extremely white, and which is called Cotton. They separate the Seeds from the Cotton by a Mill, and then spin the Cotton, and prepare it for all Sorts of fine Works, such as Stockings, Wastecoats, Quilts, Tapestry, Curtains, and Conveniences of all Kinds. With this they likewise make Muslin, and sometimes mix the Cotton with Wool, sometimes with Silk and Gold itself. After this Account, can your Ladyship still despise our *America*?

Countess. I am very well pleased with it for producing your Cotton. But are your *Iroquois* the People that prepare it? I believe they are obliged to our Fingers for this.

Count. Since the *Prior*, in the Quality of an *Iroquois*, has taken upon him to be an Advocate for Cotton, I intend, in the Character of a *Chinese*, to make Cotton likewise the Claim of *Asia*, where it is gathered, and where they manufacture it much better than in *Europe*. And I am also to boast of a Plant that is still more admirable, I mean the Aloe of *China*, to which your Part of the World can produce nothing comparable. But our Aloe must not be confounded with that Plant

The Aloe
of China.

Plant * which bears long pointed Leaves, is so very flow in producing its Flowers, and from which they pretend to gather Silk, and which Plant is commonly one of the Ornaments of your Druggists Shops. Our Aloe is a Tree as tall as that which bears Olives, and of the same Shape; under its Bark it contains three Sorts of Wood; the first is black, solid, and weighty; the second is of a tawny Colour, and as light as rotten Wood; the third, which is at the Heart, has a very strong but agreeable Odour.

The first is called Eagle-wood, and is very scarce; the second, Wood of Calambouc; it is brought into *Europe*, and esteemed there as an excellent Drug; it burns like Wax, and, when thrown into the Fire, diffuses an aromatick Scent. The Heart, which is called Wood of Calambac, or Tambac, is more precious in the *Indies* than Gold itself. It is used for perfuming Habits and Apartments, and is a Cordial in fainting and paralytic Fits. And in this Wood they likewise set some of the most precious Jewels of the *Indies*. These are not the only Advantages of our Aloe: The Leaves of this Tree serve instead of Slates for covering

* Diction. Savari. Pomet. Hist. des Drogues.

Houses;

Houses; they are also formed into the Shape of Dishes and Plates, and when they have been well dried, may be used at Table. When they are stripped of their Nerves and Fibres betimes, these are manufactured into a Thread that is used in the same manner as your Hemp. The Points which rise on the Branches serve for Nails, Darts, and Awls, with which last the *Indians* pierce their Ears, when they design to honour the Devil by some extraordinary Austerities. If any Cavity be made in the Tree, by cutting out the Buds, a sweet and vinous Juice flows from the Wound in a prodigious Abundance; it proves a very pleasant Liquor, and after some Time changes to an agreeable Vinegar. The Wood of the Branches is good to eat, and has the Flavour of a candy'd Citron. The very Roots are likewise useful, and Ropes are frequently made of them. In a word, a whole Family may be supplied with Food, a Habitation, and Rayment, by an Aloe.

Countess. I confess this is a very valuable Tree, and happy is the Person who can possess one. But History tells us there are but few of the Species. As to the rest, take all the Aloes together, and join to them every Cocoa Tree in the *Indies*, of which such Wonders are

still

still related, and the Whole will be nothing comparable to our Hemp; because those great Trees are a long time in coming to Perfection, and will not grow in every Soil; besides which, they must be destroyed to be useful; whereas Hemp thrives in all Places; and as it is sown and gathered every Year, is not only valuable for its excellent Qualities, but still more for that Abundance which nothing can equal, and which makes it the Delight of the Rich, and the surest Relief to the Poor.

Prior. Let us fairly acknowledge that her Ladyship, in chusing a Plant the least alluring to the Eye or Curiosity, has fixed upon that which, next to Corn, furnishes Mankind with the greatest Number of real Advantages and Accommodations.

Countess. Let us know, *Chevalier*, what Plant you declare for? You may chuse one that is foreign, or keep to the Growth of your own Country, as you please. You Philosophers are Natives of all Nations.

Chevalier. I should be for the Plant The Sugar Cane. that produces Sugar.

Countess. You are very much in the Right. This Plant which we want is Ibid. the Riches of the Country where it grows,

grows, and furnishes those to whom it is imported, with a thousand Advantages.

Chevalier. I should be glad to know the Shape of the Plant, and in what Manner the Sugar is extracted from it.

Countess. I freely acknowledge that I know nothing of the Matter. Put this Question to our *Americans* here, and they will entertain you with several Novelties about it.

Prior. Sugar is properly nothing more than the Salt found in the Juice or Pith of a Reed cultivated in the *East-Indies*, and still more in *America*. A Sugar-Cane, when sunk in a Furrow of Earth, shoots out from each of its Knots another Cane, which rising to the Heighth of seven or eight Feet, produces a Cluster of Leaves very like our Flags, and a Sprig terminating in a Tuft almost like our common Reeds; ours are only useful by being sometimes formed into very pretty Distaffs; but the Sugar-cane is impregnated with a delicious Syrup. These Tubes or Canes are bruised under the Beam of a Mill, by the Labour of those unfortunate Slaves whom Merchants that call themselves Christians buy like Horses or Oxen, at *Senegal*, and in the Kingdoms of *Guinea* and *Angola*. The Juice, after

ter this, is boiled successively in five different Kettles, and, by the various Changes it undergoes, the Syrop is separated from the essential Salt it contains. It was formerly thought sufficient only to begin this Separation, and send the Sugar from the *Indies* to *Rouen*, *Orleans*, and other Places, to be compleated: But it is now sent to us in Loaves, well purified and refined. This is the Origin of Sugar, which we make no Scruple to prefer to Honey, so much esteemed by the Antients. We are no longer in Pain at the Accidents that may render the Labour of the Bees unsuccessful. The vast Regions and Islands in the Heart of the Torrid Zone are annually covered with an Harvest of Canes, out of which the Syrop is first extracted, and afterwards that delicate Salt which is now so universally used, either to preserve what would not otherwise keep, or to season that which would be insipid without this Expedient, or too poysonous with our common Salt, or disagreeable by its natural Bitterness.

Chevalier. I am strangely surpris'd to hear of Salt in a Plant.

Prior. All Plants and Bodies have their Salts. When the Chymists make a Solution of a Body by Fire, they always

ways find more or less Salts in what remains after the Distillation. The Ashes that fall from the Wood we burn are nothing but the earthy Parts, and the Salt of the Plants that was thrown into the Fire.

Count. I beg we may have no more Talk of Salts and Chymistry till the next Year, and let us not so much as attempt to give an orderly Detail of Plants in particular: We may one Day take a cursory View of medicinal and aromatic Plants, as well as those proper for making Drinks that are in daily Use: Let us employ the Moments that are left us this Day, in a slight Examination of those which are most frequently spoken of, and from the Knowledge of which we may receive the greatest Benefit.

Chevalier. I should be glad never to have had any Occasion to be acquainted with Manna, Rhubarb, Ipecacuanha and Quinquina; but I know the Efficacy of these Medicines, tho' I am ignorant of the Country from whence they come.

Manna.

Count. Manna is a Sugar, or Species of natural Honey that flows from the Leaves of the Ash-Tree in *Calabria*, at the Southern Extremity of *Italy*. These Kinds of Fluxions are frequent*. The

* Savari. Dist.

proper

proper Vessel supplies all Trees with this Fluid; but our Linden and Poplar Trees are all covered, especially in the Spring, with a gummy Juice that transpires through the Pores of their sprouting Leaves; it has a charming Odour, which seems by its Agreeableness to promise us something advantageous, and perhaps the Experience of it may one Day prompt us to use it. 'Tis an Opinion that begins to prevail, and which cannot be too popular, that God has stored every Country with Remedies for the Distempers incident to it, and that we have a Multitude of Plants around us, that tender us their Services; and perhaps had we less Inattention and Impatience, we might have no Occasion to resort to foreign Remedies, which are always very dear, and often adulterated and converted into Poison by the Avarice of the Merchants, or impaired by Age. But whilst we are waiting for repeated Experiments and Discoveries in Consequence thereof, it must be allowed, that we have no better Remedies than those the *Chevalier* has named, and their Success in some Distempers is almost infallible.

Rhubarb is the Root of a small Tree Rhubarb.
that grows only in *Asia*, and especially
R in

in *Tartary*. That of *America*, which has been thought to be of the same Nature, has not been as yet sufficiently proved.

Ipecacu-
anha.

Ipecacuanha is the Root of a Tree to be found in no Country but *Brasil*.

Quinqui-
na.

Quinquina is the Bark of a Tree that grows no where but in *Peru*: In several Countries it is called Jesuit's Bark, because we are indebted to those Fathers for this precious Remedy. Sir - - - *Talbot*, an *Englishman*, has made it much more useful and common than it was formerly, by the Manner in which he has taught us to prepare it.

1706.

They now begin to use the Bark of a Tree in *Cayenne*, called *Simarouba*, and we are * informed, for certain, that it presently suppresses the most inveterate Dysenteries.

These four Remedies so efficacious, and justly esteemed, are only the Roots and Barks of some particular Trees. After the proper Juice they are capable of containing, we can have no Conception of any thing more than little Vessels, Fibres, and Air-Vents; or, in other Words, a System of Vessels appointed for the Filtration or Passage of Juices extremely minute. I am apt

* Memoir de l' Acad. des Scienc. 1729. M. de Jussien.

to suspect that these Barks and Roots, when they are reduced to Powder, and received into the Body, are only like a Number of little Sponges, whose Pores and Orifices are proportioned to the extraordinary Smallness of the Acids which disorder and afflict the Patient. These Acids insinuating, or rather sheathing themselves in the Sponges opened wide enough for their Reception, and sufficiently compact to retain them; the Acids, Sponges, and Indisposition, are all carried off, and dissipated by degrees. This first Suspicion that seems to have some Probability, makes me entertain a second, which is, that we may find in our own Country, a Root or Bark which would produce the same Effects.

Prior. The Root of our Gentian is Gentian.
no way inferiour to the Jesuit's Bark in Intermitting Fevers: And be pleased to take Notice, that I am still speaking of a Root.

Count. 'Tis to be hoped that some future Experiences will discover to us our own Riches.

Countess. Gentlemen, you are treating Physick in a very rational Manner; but there are Plants whose Use and Efficacy are more agreeable: And I desire to know from whence we have

those Drinks or Infusions that are become so fashionable, I mean Tea, Coffee, and Chocolate.

Tea.

Count. Tea is nothing more than the Leaf of a Tree that grows only in *China*. The Tea Leaves, when steeped in a little warm Water, and corrected in their Bitterness by a small Quantity of Sugar, diffuse the Scent of a Violet, and a Volatility which in some measure refreshes the Brain, and besides these Qualities, it has the Reputation of being an Aperient.

Coffee.

Coffee is a little Berry gathered from a Tree in *Arabia Felix*, towards *Aden* and *Mocha*, and they now begin to cultivate it with Success in the Parts adjacent to *Batavia*, and in the Isle of *Bourbon* near *Madagascar*, which belongs to the *French*. This Berry is roasted in a Stove, and ground to Powder. The Infusion, tho' it be something bitter, has a very agreeable Scent and Flavour. But this Liquor, which is good to quicken both the Brain and Blood, when the Dose is but small; throws the Blood into an Agitation, and causes an Indisposition to sleep, when taken in too great a Quantity. To the natural Volatility of this Fruit, a Number of fiery Particles are added, which remain

remain under the Coat of the roasted Berry. This Fire, which is swallowed down with the fine Powder of the Coffee, must certainly disorder the Blood, in proportion to the Quantity drank.

Chocolate, which is diluted in warm ^{Choco-} Water in order to make a nourishing ^{late.} Liquor, is a Paste whose chief Ingredient is the Powder of Cocoa-Nuts, which ^{The Co-} are taken out of a long Shell, shaped ^{coa.} like a Cucumber; and to these Nuts there is an additional Mixture of some particular Drugs. The * *Mexicans*, in whose Country the Cocoa Trees grow in the greatest Abundance, take the Nuts and mix them with *Indian Corn*, and such Sugar as they extract from their Canes, adding a few Seeds of the Rocou, which are coloured with the finest Vermilion in the World. They grind all these Ingredients between two Stones, and work the Mixture into a Paste, which they eat dry when they are hungry, and dissolve it in warm Water when they would quench their Thirst.

The *Spaniards*, who find this Composition very beneficial and acceptable, and know it to be a Commodity that will have a sure Consumption, are so industrious to bring it to Perfection, and make it extremely valuable, that at

* Savari.

R 3

present

present a Garden of a moderate Size, planted with Cocoa Trees, is worth above Twenty thousand Crowns to the Proprietor. Complaints are made, that the *Spaniards* mix with the Cocoa-Nuts too great a Quantity of Cloves and Cinamon, besides other Drugs without Number: The Grocers in *Paris* use few or none of these Ingredients, and have much less Regard for Musk and Ambergrease which a Number of People are fond of to Infatuation; they only chuse out the best Nuts, which are those called *Carracca*, because they are brought from the Parts adjoining to the City of *Caraccos* in *Terra Firma*; with these Nuts they mix a very small Quantity of Cinamon, the freshest Vanilla, and the finest Sugar, but very seldom any Cloves; and they have now the Art of making such Chocolate as is universally esteemed. However, *Paris* has its Cheats too; and one must be very diffident of the Chocolate which is sold by the common Hucksters.

Chevalier. I know nothing of the Vanilla his Lordship has mentioned; and am as much to seek, with Respect to Cinamon and Cloves.

Vanilla.

Count. Vanilla is a Shell full of a luscious Juice, and little black Seeds
of

of a most agreeable Odour. It is gathered in *America*, and especially *New Spain*, from a Tree of the same Name.

Cinamon is the Bark of a Tree found Cinamon. only in the Island of *Ceylon*. The *Dutch* have destroyed it in every other Place, and monopolized the Commerce of it to themselves. * When the Fruit of the Cinamon Tree is boiled in Water, it produces an Oil which fixes and thickens like Tallow, in Proportion as the Water cools: Of this Oil they make Candles perfectly white, and which are reserved for the King of *Ceylon*. There is also the white Cinamon of *St. Domingo* and the *Antilles*; but this is very little esteemed.

The Clove is a small aromatic Fruit The Clove. shaped like a Nail, with a Point and a Head divided into four Quarters. It grows on the Clove Tree in the Island of *Ternate* †. This Tree was once very common in all the *Moluccoes*; and every Nation furnished themselves with Cloves at full Liberty. But the *Dutch*, whose Patience the greatest Obstacles could never weary, have either engaged or constrained the Natives of these Islands to destroy all the Clove Trees except those in *Ternate*, where the

* Journ des Sav. Jan. 11. 1684. † A small Island lying Westward of Gilolo in the Moluccoes.

Dutch are Masters. They have likewise the best Settlements in those Countries that produce Pepper, Nutmegs, and Mace; which last is the Shell of the Nutmeg, and much more esteemed than the Nut itself: So that by these means they are become the Medium of this Kind of Traffick to almost all *Asia* and *Europe*. And thus you see, in a few Words, the Origin of our fashionable Infusions and best Spices.

Countess. I am dissatisfied with some Circumstances in these *Indian* and *Turkish* Liquors which prevail so much among us; one is, the Necessity of preparing them every Time you intend to use them; and the other is, the Difficulty of preserving the proper Ingredients of this Preparation. They all evaporate and lose their Spirits, and we must be constantly renewing our Stock.

Count. On the other hand, 'tis the Privilege of our best Liquors to retain their Perfection many Years: Burgundy preserves its Excellence even in *Persia*, where *Tavernier* made a Present of some to the Sophy, who preferred it to his Wine of *Schiras*: And Champagne, which *Monf. St Evremond*, who in Matters of Pleasure was undoubtedly a good Judge, called the best Wine in the Universe, is preserved in
Bottles

Bottles nine or ten Years, and even more, when it happens to be rightly managed.

Prior. If our European Liquors keep Corn longer than those of *Asia*, 'tis the very same with our Corn, compared either with the Magnoc Root, of which the *Americans* make their Bread, or the Pith of Sago, which serves for Bread in all the *Moluccoes*, or indeed, with all the Plants which the Natives of different Countries have endeavoured to substitute in the Room of Bread. We ought to offer up our Gratitude to the Deity for a Nourishment the most perfect in its Kind, and whose Production and Preservation are most easily accomplished. When Corn is well managed it may be made to keep an hundred Years and more, if such be the Intention.

Chevalier. An hundred Years! I have known Corn grow bad in less than three. What Method then must be taken to preserve it?

Count. At first it must be removed every * fifteen Days for at least six Months successively, if you intend to preserve it; after this, it must be removed once a Month, and sometimes

* Memoir de l'Acad. des Scienc. 1708.

oftener:

oftener : They shift it from Place to Place with a Shovel, that the Dust, Impurities, and heated Air may be dispersed. When the Corn, by this Proceeding, has exhaled all its fiery Particles, it may be kept as long as you please, provided the Roof of the Granary be of a reasonable Heighth, and all Humidity excluded. But in order to frustrate the bad Impression of the Air, and prevent the Entrance of Vermin, who grow as numerous there as the Corn itself, and dig each of them an Habitation in every Grain, the most effectual Method is to spread a little unslaked Lime over the Heap, and sprinkle it lightly with Water ; the Particles of Fire that are inclosed in this calcined Stone, escape through the Apertures made by the Water ; the Lime melts, and becomes like a Jelly of a perfect Whiteness : It then insinuates itself, through the whole Surface of the Corn, two Fingers in Depth ; and this Mixture of the Grains and Jelly forms a Crust which prevents the Corn from taking Air, as well as over-heating and shooting forth.

Prior. In the Year 1707, they opened, in the Citadel of * *Mentz*, a Magazine of Corn which had been stored up

* *Memoir de l'Acad. Scienc.* 1708.

in 1578, and the Bread that was made of it proved very good. When the *Abbé de Louvois* travelled to the Frontiers of *Champagne*, as he was one of the most judicious Men in the World, and indefatigable in his Endeavours to be informed of all that related to the Arts and Sciences, he visited all Parts, and had every where a favourable Admission: In particular, they shew'd him, in the Castle of *Sedan*, a Heap of Corn which had been lodged there an hundred Years, and preserved, notwithstanding the Humidity of the Place, which at first made it sprout above a Foot deep. The Leaves and first Shoots of the Stems, which had already risen to a certain Heighth, wanting Air, began to rot, and sunk down upon their Roots; and this glutinous Dunghil, incorporating with the Grains beneath, and growing dry, harden'd into a very thick Crust, which preserved the rest of the Heap. Some of the Bread made of this Corn was sent to Court, and proved extraordinary good.

Chevalier. If this be the Case, we never need to be apprehensive of Famine. When the Harvest is plentiful, a Quantity of Corn might be stored up, and then we should not be obliged, in Years of Scarcity, to purchase it from foreign

reign Countries at an extravagant Price.

Count. This Precaution is taken by the *Dutch*, who have always a double Provision. But the Attempt might seem very great for such a Kingdom as *France*, though at the same Time it must be acknowledged, that were this Expence once made, it would secure the Indigent from enhanced Prices, and the Rich from Insults ; and by keeping off a Famine, would preserve us from the greatest of all Calamities, because it never fails to carry off one Part of the Inhabitants, and always exposes the other to the Dangers of Sedition and contagious Distempers.

Prior. The Precaution you mention, would not only prevent the Mischief, but would even dissipate the Apprehensions of it, which are sometimes as terrible as the Calamity itself. Two or three Moons unfavourable to the Fruits of the Earth, are alone sufficient to shut up all the Granaries, and introduce a Famine, when there is even a real Plenty ; and then the Disorder and Alarms will be universal, and not to be prevented or checked by the utmost of human Wisdom ; whereas one Magazine of Corn, wisely raised and regulated in every Canton of the Kingdom, would intirely root out all these Disasters.

Count.

Count. All these plausible Projects are easily formed by such speculative People as ourselves, who know nothing of the Necessities of State. The Affair has been frequently proposed, always relished, and as constantly obstructed by several Accidents : For our Parts, we have only to express our Wishes in this Particular ; and as to the rest, must repose our Confidence in the Wisdom of the Government. Instead of regulating the State, let us adjust our Plants, from which we have made a little Digression.

Countess. I advise you, Gentlemen, to keep to what has been said : But to put the *Chevalier* into a Condition of knowing much more than he can learn from you in the little Time we have to be together, I will give him this good Counsel : After his Return to *Paris*, let him frequently make his Court to the Gentlemen who are the Directors of the Royal Gardens ; his Eyes and Ears will be constantly entertained with what is curious and real. Of all Employments, none is more simple, more natural to Mankind, or more amusing than the Cultivation of Plants. For my Part, I am so delighted with it, that I never pass a Day without walking round my Parterres
and

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and

and Kitchen Garden; I have there daily Discoveries of some agreeable Novelty; both the Mind and Body equally find their Account in this Exercise; and, to inspire the *Chevalier* with an Inclination to it, I must inform him, that the Culture of Plants is altogether as noble as it is entertaining: It has constantly had Charms for Kings as well as Subjects; and 'tis now very common to see Men of the first Quality in *England* and *France*, applying themselves to Gardening and Husbandry, and the proper Methods of bringing both to Perfection.

Prior. It is a known Fact that at present the most polite and understanding People make their Garden not only a Pleasure, but a very serious Affair. The Art of managing a Kitchen Garden especially, was never carried to a greater Height; and we see some of these where the Eyes are as much delighted with the Propriety of the Cultivation, as they are with the most regular Parterre, and where the Discovery of a thousand new Secrets for improving the Fertility of Plants, and perhaps making the Species more diversified, must produce Pleasures that are incomparably more entertaining than any that the regular Shape of Yew or Box Trees formerly afforded.

afforded. This Taste does Honour to the present Age, and makes it evident that we have not always a Contempt for what is Solid, and can be Rational in our very Pleasures. But I wish the Cultivation of Plants were like true Piety, freed from every vain Scruple, and disencumber'd of every superstitious Practice. People are as much infatuated as ever with the Influences of the Moon and Planets over Husbandry and Gardening, and with the greatest Regularity forbear either to plant or fell in the Wane of the Moon. Deep Study has assigned particular Days for that Employment, and the Knowledge of these disagreeable Practices frequently constitutes the whole Abilities of some impertinent Gardiners, though at the same Time the Falseness of these pretended Rules is daily evinced by a thousand Experiences, and the Gardiners themselves must needs be sensible of their Insignificance; but when a Plant happens to succeed well, they congratulate themselves for having chosen a proper Day for its Plantation, and the Time of the Moon must be set down amongst their *Agenda*; and when ever the same Plant, sowed or planted by their Neighbour at a very different Time thrives, better than their own,

An Inquiry whether the Moon has any Influence over Plants or not.

own, they immediately impute this to the Soil, Air and Winds; in which indeed they are reasonable enough; but then they still retain their old idolatrous Respect for the Moon.

Count. You atone for the Offence you gave me a Moment or two ago, when you talked of Moons unfavourable to the Fruits of the Earth.

Prior. I spoke the usual Language, but joined to it very different Ideas; as the Continuance of Winds that operate so powerfully on the Productions of the Earth, and even our Bodies, is commodiously measured by the Duration of the Phases or various Appearances of the Moon; and as we say the First Quarter has been rainy, and the Second hot, we are therefore apt to ascribe that to the Moon, which in reality proceeds only from the Air.

Count. I lately was shewn the very same Remark in a Letter written by *Monf. Normand*, who has the Direction of the King's Fruit and Herb Gardens; where it is asserted in express Terms, which I still remember, "That from a
" vast Number of Experiments made
" with the greatest Exactness, and in
" different Years, on all the Operations
" of Gardening, he had never met with
" one that favoured the Subjection of
" our

“our Fathers to the different Aspects of the Moon.” The Authority of such a Man, who joins the politest Literature and the justest Taste to a most consummate Experience, made a greater Impression on me than all the Harangues of a thousand pretended Connoisseurs. It was the Opinion too of Mons. *Quintinie* his Predecessor, that nothing was more frivolous than to amuse ones self with observing the Day of the Moon when we intended either to plant or fell, that in Reality we ought to do every thing in its proper Season, and chuse a favourable Period, in the best Manner we are able, and then wait for the Success, not from the Day we have chosen, but from the Operation of the Sun, and the Dispositions of the Air and Atmosphere.

Chevalier. Since the Influence of the Sun and Winds is so well known, Why do People then so obstinately ascribe Effects to the Moon, whose Operations are not to be perceived?

Prior. 'Tis an old Prepossession, and a true Remainder of the ancient Idolatry. The first Men who regulated the Year after the Deluge, made use of a Method extremely commodious, and which they found obvious to all the World, in order to adjust the different
S Portions

Portions of the Year, and the Labours peculiar to each Season. They chose the various Appearances of the Moon; and as they always had Recourse to this Planet to fix the Time of their Labours, they began by degrees to imagine, that even these were influenced by the Moon; and then ascribing new Efficacy to her in proportion as she approached to the Full, they at last became persuaded, that what they sowed either in the Increase or Full of the Moon, was impregnated with more Vigour; and, on the contrary, that what they sowed in the Wane corresponded with the Moon's pretended Imbecility. Crabs and Oysters being frequently observed to be fat, and in a good Condition at the Full, gave them, as they imagined, an Opportunity of improving the Growth and Vigour of these Creatures into a Rule and Proverb, which a thousand Experiences have since refuted to no purpose. And as bad Winds sometimes happen to blow in the Wane of the Moon, this Circumstance was sufficient to give that Period a bad Reputation; for which Reason it continues to be unfavourably thought of to this Day.

Count. But what do you say of the Stars; and why were they imagined to have

have so much Force and Influence over us, that several People even now ascribe to them all the Good and Evil which fall to our Lot?

Prior. This has been occasioned by much such another Mistake as the former. The various Situations of the Sun, who is placed sometimes under one Constellation, and sometimes under another, have induced People to impute to those very Constellations, any excessive Heats, any Rain or Winds, that happened under these different Aspects. They afterwards proceeded to search for the very Original and Fate of every natural Transaction in the different Situations of the Planets, and the Aspect of such and such a particular Star: And this it is which has swelled the Works of the Antients, and especially those that relate to Agriculture, with so many useless Observations and false Maxims. The *Georgics* of *Virgil*, which we may call the most compleat Piece we have remaining of Pagan Antiquity, are disfigured by an hundred frivolous Remarks on the good or bad Qualities of some particular Days of the Week or Moon, and on the Variations of the Air; which the Poet boldly ascribes sometimes to the Aspect of the Dog-Star, sometimes to the Setting of the Plei-

ades, the Rising of *Orion* or the Kids; tho' the contrary frequently happened, as it does now. The best Excuse that can be offered for him is, that 'tis impossible to express in finer Verse those false but popular Ideas to which he was enslaved by Education.

Chevalier. Since we are got among the celestial Animals, who have been thought to act so powerfully on those Animals and Plants that cover the Earth, permit me to ask you, Why the Names and Figures of Animals were ascribed to the Stars? What is the Origin of the Ram, the Bull, and all the rest that I have seen in the Zodiac? I have been told their Names and Situations, but was never instructed in the Reason of these Things, which I always thought extraordinary, tho' I hear them talked of every Day.

The Vanity of Judicial Astrology, and the Origin of the Zodiac.

Prior. 'Tis not easy to give you full Satisfaction with respect to this odd Language, that seems to have been introduced among Men from the eldest Antiquity. Some Distinction must however be made, and we are not to form the same Judgment of the Names of the Twelve Signs of the Zodiac, as we do of the other Constellations of the Sphere. The Learned are of Opinion, that the *Egyptians* gave to the Twelve Signs

Signs the Names of as many different Animals; and this they did according to their Custom of disguising remarkable Things under the Symbol or Form of some Animal, or known Object that had any Relation to the Thing disguised: For instance, I am very much tempted to believe, that they represented God and his Attributes; such as his Immensity, his Omnipotence, his Fecundity and Purity, under the Symbol of the Sun; and that they represented Nature, or Matter which is intirely dependent on the Deity, and perpetually diversified, under the Image of the Moon, which derives its Light from the Sun, and constantly varies its Appearance; and this perhaps might be one of the principal Causes of Idolatry; Men, by degrees, growing forgetful of God, and confuing their Attention to the Sun, or even considering it as his Representative. But, however the Fact may be, it is certain, that the *Egyptians* were extremely devoted to Hieroglyphics, and that the Twelve Portions of the Zodiac were always called by the Names of different Animals intirely conformable to the *Egyptian* Method and Taste, and they are capable of some reasonable Explications. But for the Generality of the other Stars of the

Sphere, *Greece*, in mere Caprice, assigned Names to them, but for what Reasons we must not attempt to discover. The *Greeks* imitated the *Egyptians*, in giving the Names of Men or Animals to the Stars; with this Difference, that the old *Egyptians* gave symbolical Names to some Stars, on Account of some Conformity between the Symbol and the Constellation; whereas the *Grecians*, who were unacquainted with this Similitude, and struck with Admiration at the Wisdom of the *Oriental*s, but had a depraved Taste for Fable, invented an hundred wretched Conceits concerning the Origin of the Animals of the Zodiac, and applied to the other Stars the Names of Animals and Heroes that were most known in their ridiculous Metamorphoses.

Chevalier. Let us leave the *Greeks* then with their Fables: But what Reasons could the *Egyptians* have for calling one Set of Stars the Crab, another the Lion, the Virgin, or the Fishes?

Prior. The old *Egyptians*, after they had observed the four natural Portions of the Year, saw that the Sun in each of these Seasons was placed successively under different Stars. For the greater Exactness then, and to parcel out the Year in a commodious and invariable

variable Manner, they divided each of the four Seasons by three Cantons of different Stars; and the whole Year into Twelve Houses or Stations of the Sun, to which they gave the Names of twelve Animals, who were relative to what passed on the Earth in every one of those Portions of the Year.

The Sun, in Spring, covers the Earth with Blessings, and those which the Antients were most desirous of obtaining, and for which they had the greatest Regard, were Sheep, Kine, and Goats. To adumbrate the Benefits and Fecundity restored to them by the Spring, they gave to the Three Constellations, through which the Sun took his Progress in that Season, the Names of these three Species of Animals. The first Constellation under which the Sun is discovered at the Close of Winter, when the Days and Nights are equal, had the Title of the first Animal who is commonly born at that Period, I mean the Lamb, or the Parent of that Creature, which is the Ram. To the

Aries, or
the Ram.
Taurus, or
the Bull.

second they gave the Name of the Bull: And as the Goats, who are hot in November, and pregnant for the Space of five Months, bring forth at the Expiration of that Time Two young ones for the Generality, they assigned to

Gemini,
or the
Twins.

this third Constellation of the Spring, the Name of the Twins, or the Kids, instead of which the *Greeks*, without the least Reason, have substituted the two Brothers *Castor* and *Pollux*.

Cancer, or
the Crab.

When the Sun is arrived at the Summer Solstice, he discontinues his Progress towards the Pole, and begins to return with a retrograde Motion to the Equator, for which Reason the *Egyptians* thought fit to appropriate the Name of the Crab to the Stars under which he then appears; every one knows the March of this Animal, and nothing could more properly intimate the Retrogradation of the Sun. The excessive Heats that follow, made the Sun to be then thought in his full Vigour, which they delineated, by giving the Constellation under which he then moves the Name of the Lion, the most formidable of all Animals. The Harvest, which immediately succeeds, made the sixth Constellation be characterized by the Figure of a young

Leo, or
the Lion.

Virgo, or
the Virgin
or Ear of
Corn.

Female Reaper, bearing an Ear of Corn. The Symbol is taken from those young Damsels who gained their Living by gleaning after the Reapers; and nothing could better mark out that Season of the Year when Providence supplies the Rich and Poor with their necessary

cessary Provisions. The *Chevalier* will be pleased to take Notice, that the Ear of Corn which she has in her Hand is called *Shibboleth* in the *Hebrew* Language, and in the *Arabic*, *Sibbul* or *Sibbula* — *Hebrew* and *Arabic*! What Conversation is this? Let us defer it to the next Year.

Countess. Let me intreat you, Sir, to proceed, you are going to discover to us the Origin of the *Sibyls*, and I have as much Curiosity as another Person.

Prior. The Name of the Ear of Corn or the *Sibyl* was given to the Virgin herself who carried it. Nothing can be more simple than this Name in its Original. But Fables afterwards came into Fashion, and an History was formed out of what was only designed for a Symbol. It was pretended that this *Sibyl* had been conveyed from the Earth into Heaven; and to qualify her for the Journey, they furnished her with Wings in the Figures by which they represented her, and did not forget to affirm, that the Spirit of God was infused into her, and that she foretold Years of Plenty and Sterility. From hence came the *Erythræan Sibyl*; and the History of those of *Persia* and *Cuma* was cast in the same Mould. All those

those Women or Priestesses who took upon them to divine or collect Prophecies, as well those that were antient and true, as such that were modern and false. But we have dwelt too long on this Subject, let us return to our Constellations.

Libra or
the Ba-
lance.

Scorpio,
or the
Scorpion.

Sagittarius,
or the
Archer.

Capricorn
or the
Goat.

The Constellation under which the Equinox happens, which equals the Days and Nights, could not be expressed by any thing better than the Idea of a Ballance in *Equilibrio*. The Distempers caused by the Sun in his Retreat, or which break out at the Middle of Autumn, gave the next Set of Stars the Name of the *Scorpion*, because this Animal bears a Sting and a Bag of Poison in his Tail, and makes use of both in his Flight. The *Sagitary* or Archer who comes next, has a Relation to Hunting, which is a Diversion chiefly followed after the Fall of the Leaf. The *Greeks*, instead of an Hunter, have substituted the fabulous Idea of a Centaur. As the Crab, who marches backwards, represented the Summer Solstice, after which the Sun always returns to the Equator; so on the Contrary, in order to describe the Winter Solstice, after which the Sun ascends and continues mounting to the other Tropic, the Name of the Goat or *Capricorn* was chosen,

chosen, because these Animals generally climb when they are feeding, and, as they ascend, always continue browsing till they have gain'd the Summit of Rocks and Mountains. The Water-Pot may very well represent Rains and Snows, and the melancholly Season of Winter; and lastly, the two Fish which are united by a Band, seem to relate to the Generation of those Animals who appear about the End of Winter, at which Season the Fishery begins to be good.

Aquarius,
or the Water-Pot.

Pisces, or
the Fish.

Pardon the Liberty with which I have offer'd you my Conjectures. I am sensible that all of them are not equally satisfactory.

Count. Your Explications have an Air of Probability, and though they should not happen to be all equally happy, 'tis sufficient that there are some which are natural and agreeable to Reason, and capable of making us comprehend, that some such Conformities as these gave the Ancients an Opportunity of naming the Twelve Signs of the Zodiac in the Manner they have done, which at one Stroke saps all the Foundations of judicial Astrology, and the superstitious Practices in Husbandry.

Chevalier. I am going to add all this to the Memorandums I have taken of
our

our past Conversations, and shall beg the Favour of the *Prior* to revise the Whole this Afternoon and To-morrow, before my Departure ; for I intend to communicate to my Friends all that I have learn'd here.

Countess. Chevalier, if you will oblige us with your Company the next Vacation, I promise you a second Tome, provided the *Prior* and his Lordship will be my Sureties.



A



A

LETTER

FROM THE

Chevalier *Du Breuil*,

TO

Mons. the Prior *De Jonval*.

SIR,

I HAVE this Moment been writing to the *Count* and *Countess* of *Jonval*, to express a thousand Acknowledgments to them for the obliging Reception they gave me, and principally for their charming Conversations, and now permit me, my dear *Prior*, to testify my perfect Gratitude to you. The most delightful Days of my Life were those I lately passed in your Company. You have led me into another World, that is altogether enchanting. Till then, I beheld

held all Objects like a Child, but you have taught me to see with my own Eyes, to know whatever is made for me, and to enjoy my due Prerogative. I have imparted the Pleasures of my Vacation to my Brother and his young Spouse. All our Family begin to be Philosophers, and every Thing engages our Attention. We have a great deal to say to you on whatever is presented to us in our Walks, or served up at Table. The Shell of an Oyfter, or the Coat of a Nut, employs us for several Hours. We are endeavouring to discover the Original, the Structure and Use of every Thing we see. But we had Yesterday a Dispute on this Subject with our Neighbour the Colonel, and I must now acquaint you with the Particulars. He pretended, that our Application to Natural History was only lost Time, and that all our Knowledge was but a Set of Misapprehensions and Uncertainties; that we might have a tolerable Idea, for Instance, of some of the larger Vessels which contribute to the Nourishment of an Animal's Body, but that we could never distinguish the other Vessels necessary to support those, and much less discover the Texture of the smallest; and yet,

yet, according to him, the Knowledge of the one was insignificant without an Acquaintance with the other ; and therefore, that it was of no Consequence to begin a Work, and enter into a Track of Inquiries, when we were very sensible we should never compleat our Design. Though the Colonel's Discourse had no great Authority with us, I was willing however to hear my Brother refute such a Train of Reasoning, and desired him to tell me if it made any Impression upon him, and if he imagined he had lost an Object that a little Mist had render'd obscure to us : I added, with a Smile, that the first Year I was at *Paris*, I had a Prospect from my Apartment of the Dome of the Invalides, and that when there happened to be any Fog, I could not imagine what became of the Dome, and fancied it was no longer in being, because I could not discover it at that Time. My Brother, warmed with my Comparison, renewed the Dispute, and maintained, against the Colonel, that these Difficulties neither destroy'd the Certainty of what we already knew, nor the Facility of acquiring new Informations ; that, indeed, some Things were concealed from us, but they did not for all that prevent others from
being

being sufficiently evident and certain, and that we were not to exercise ourselves in Inquiries that surpass our Faculties, but in those that are adapted to our Capacity. This Answer, which was judged to be very judicious, is the same, my dear *Prior*, which I heard from you in a Conversation wherein you intimated the Rights and Limits of Reason. I was exceedingly affected with all you were then pleased to tell us, and should esteem myself extremely obliged to you if you would give yourself the Trouble to write down the same Particulars, and transmit them to me at a convenient Opportunity. You have already taught me to think, and must now instruct me how to think justly. My Brother, who has seen my Letter, and made some Additions to it, especially in what relates to himself, pays you a thousand Respects, and joins his Intreaties with mine, that we may be indebted to you for an Illustration of the Subject I have propos'd to you.

We have no Intention to make the Colonel a Convert; we should only find our Labour ineffectual; but we are desirous of being preserved from his Misapprehensions.

I am, &c.



A
L E T T E R

FROM THE

Prior *De Fonval*,

TO THE

Chevalier *Du Breuil*.

On the Extent and Bounds of
REASON.

S I R,

I T is no longer necessary to inspire you with a favourable Idea of the Advantages of the Arts and Sciences, in order to excite your Curiosity : That Affair is already compleated, and I am sensible that the Desire of Knowledge is at present your most prevailing Passion : But then this Passion, so commendable in itself, and so fertile in its happy Consequences when it happens to be well regulated, may, like several others, be indulged to an immoderate
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Degree. We see some Persons, who, instead of acquiring Solidity, are only elated by Knowledge; and these are learned Men, of whom it may be justly said, that it had been better for themselves and others, if they had continued in their original Ignorance, and not abused their Attainments, and perverted the Use of Reason in the Manner they are seen to practise.

It is certainly good to be curious, and No-body will contradict that Truth; but still this Curiosity must be conducted with Moderation, and we ought to be acquainted with its Limits, in order to confine it within their Circumscription: And this is the Subject, which, in Obedience to your Request, I now propose to examine. This Essay, my dear *Chevalier*, may seem to you a little abstracted, and not so intelligible as our former Conversations. But let me advise you, at your first reading of what I have now to offer, to consider it only as an History, without giving yourself any great Perplexity to comprehend every Particular. At the second reading you will find it more familiar; at least the worst that can happen, will be for you to place this Letter at the End of the Journal of our Conversations, after you have communicated it to your Brother

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and to defer reading it till you have made some farther Advances in Philosophy.

The Bounds of Curiosity are undoubtedly the same with those prescribed to the Reason of Man in general, and to the State of each Individual; but for want of knowing the Measure and Intention of our Reason, we frequently deceive ourselves in the Choice of Things we desire to know, as well as in the Degree of Perspicuity to which we would willingly extend our Knowledge. It is, however, of infinite Importance to us, not to entertain wrong Apprehensions on this Occasion, and to make a just Estimate of the Power and Incapacity of Reason. The Knowledge of what this Faculty can accomplish, may animate our Endeavours; and our Persuasion of its Inability in other Instances, may save us the Pains of many unprofitable Attempts. But it is a common Misfortune, and especially among young Persons, either not to be sufficiently sensible of the just Value and Prerogatives of Reason, or else to entertain too advantageous an Idea of its Power: In Consequence of which, they either totally neglect it, or endeavour to extend it beyond its Limits.

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The
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We are in this Age surrounded with Dangers. The Fickleness of Constitution; the Constraint of Attention; the enchanting Aspect of Pleasures; the seducing Power of Example; a thousand Causes may degrade Reason in our Opinion, and deprive us of the Efficacy of that Privilege which constitutes the Glory and Happiness of Man. On the other hand, the Desire of improving our Understandings; the amiable Success of some learned Men; the Honours and Advantages that attend the Sciences; the Pleasure which is inseparable from Study, our proper Talents, as well as our inconsiderate Complaisance to ourselves, when we are unacquainted with their Bounds, may lead us into presumptuous Inquiries, that either bewilder us by degrees, or tend to excite in us criminal Expostulations on the Infirmary of our Nature.

The Learned themselves, to whom we confidently apply as our Guides in a Track they ought to know better than ourselves, may be the first that contribute to our Illusion. Some of them, more fertile in Perplexities than clear Principles, are wavering in a constant and universal Hesitation. They discourage us in our Searches after Truth, and we are astonished to find so much

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Uncertainty joined with so much Wit. Their Example seduces others, who, despairing to attain any satisfactory Knowledge, resign themselves in Consequence of that Opinion to Pleasure, to Insignificance, and a Scepticism of Mind which is more remediless than bare Immortality itself. Others, on the contrary, flatter us with Promises that are by much too magnificent: They inspire us with an immoderate Opinion of the Extent of our Reason, and subject every thing to their Examination. They are never perplexed in their Inquiries; and to hear their Discourse, you would imagine they had penetrated through all the Mysteries of Spirituality and Matter. With a single Turn of Hand they disconcert the whole corporeal System, and range it a-new as they think proper. They are the Partisans of a System of Imagination that comprehends the Universe; they discover the full Play of those mighty Springs that give Motion to the World, and know the Fabrick of the minute Parts that compose it. They speak of every Particular, and give a bold Solution of the Whole.

But, alas! how frequently are we obliged to moderate these vain Pretensions? When we design to be natural

and undisguised, we are constrained to acknowledge, that if Nature be so open to our View, as to present us with a noble Spectacle, yet the internal Parts of this Appearance are withdrawn from our Observation. We are unacquainted with the Movement of the Machines; the particular Structure of every Part, and the Composition of the Whole, are Points that surpass our Understanding. We behold the outward Surface, and enjoy it, but the clear and comprehensive Knowledge of the Depths and Mechanism of Nature is a Favour not accorded to our present State.

We are like those Travellers who begin their Journey at the Dawn of a fine Day; a weak, tho' pleasing Light, begins to colour the Objects around us, and we distinguish those especially that are near us, and do not confound the River with the Banks that border it: This is sufficient for us, and enables us to continue our Journey. But the Day shines not as yet in its full Lustre.

If we would modestly enquire into the Reasons why such a small Portion of Light has been imparted to us, we shall find it wisely proportioned to our Necessities, and relative to our present State; and must acknowledge, that had it been more extensive, we should have been

been less capable of answering the End of our Creation. We are only placed here to be vertuous. Our Reason is dependent on the Senses, by whose Ministration it receives Intelligence of every thing relating to the Life over which it presides. This Reason is Subject to a Body, and accompanied with a Set of Limbs: All these Organs have been given it not for Contemplation but Labour, and the Performance of proper Actions. These are the Purposes for which we have received it, and they would have been defeated by stronger Illuminations.

A Traveller, in order to proceed regularly in his Way, should be capable of distinguishing the Objects about him, or else he can neither make Use of the one, or avoid the other; but there is no Necessity for him to be perfectly acquainted either with the Nature of the Land over which he passes, or that of the River that flows by him in his Journey; all his Business is to follow the one, and avoid the other. Were he more penetrating and curious, he would stop too long to consider the Particularities of this River; he would be desirous of discovering its Source and first Cause; he would search out the lesser Streams that swell it, and be inquisite

to know the Fish it produced, and the Qualities of the Plants that rise on its Banks; he would be perpetually wandering from Object to Object, and his Journey would never be finished. This is a just Image of our Life.

It is true, indeed, that the Study and Contemplation of Truth is necessary for us in this State; and it is highly proper there should be Travellers to discover the Ways, and set Marks and Boundaries in Places that are intricate; and likewise that their Discoveries should guide those that come after them: And these are the Benefits we receive from great Genius's, who are appointed for the Conduct and Instruction of others. But Studies that produce nothing, and Speculations that are entirely barren, and have no Tendency to improve our Hearts, regulate our Manners, or enrich Society, are Deviations and Amusements that have no Claim to our Esteem, and are substituted in the Room of necessary Labours. The Deity, by contracting our Faculties, has wisely dispensed with our engaging in these Distractions. Were our Penetration greater, we should be more solicitous to see than to act; and should certainly disdain to creep on the Earth, were it possible for us to behold or know what passes in the Stars.

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This Truth will be evidently justified if we enter into a few Particulars. Let us cast our Eyes on a Husbandman. Such a Person, consider'd in a certain Light, and in Comparison with others, seems to us as an Object of Compassion : He is unpolite, lives a laborious Life, and elegant Pleasures are no Part of his Property ; he has no Knowledge of amiable Glory, or Gold, or glittering Jewels. Has Providence then forgot this Man to lavish his Favours on others ? Nothing can be more false than such a Point of Sight : What Place does this Person fill in the Order of Providence ? He is ordain'd for the most necessary of all Employments, the Cultivation of the Earth. He is furnished then with all necessary Lights, since he has those that are sufficient for his Station ; had he more, he would not accomplish the Purposes for which he was appointed : If Pleasures and Honour were to have any Attraction for him, he would think himself wretched in the Obscurity and Fatigues of his Condition ; and it is not for his Advantage alone that his Understanding is gross and contracted within a little Compass, but it is much more for the common good of Society. Were the Peasant Master of Penetration, Delica-

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cy and Taste, Would he condescend to follow a Flock Night and Day? Would he not find himself degraded by the cumberfom and demeaning Cares with which he is obliged to tend these contemptible Animals? And yet, if the Earth and Cattle be neglected, all Society will be disconcerted and intirely destitute of Food and Raiment. The Unpoliteness therefore of the Peasant is an Advantage to us; and we discover our Ingratitude and Injustice when we reproach him for his Stupidity. But our Idea of this Man is applicable to several others. This Man of Labour and Rusticity is the whole Species of Mankind; he is our general Representative. We were all placed on the Earth to cultivate and embelish it, and make ourselves useful here by our Labours. The Diversity of Employments requires indeed some Variety in the Talents and Lights, but then these Lights and Talents have their Limits, beyond which we are not permitted to pass; and to be desirous of proceeding further, is to have an Inclination to move out of our Condition. To what Purpose is it to dive to the very Bottom of Beings; to unravel the nicest Texture of the Organs of a Body; to inquire how the Vessels that supply it
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with Life, and which are invisible to our Eyes, can subsist of themselves; to divine what are the Elements of these Vessels, and the Elements of even these Elements; in a word, to launch into Infinity itself? We were made for a very different Purpose; and to quit the Truths that are presented to us; to wander after Informations that elude our Curiosity, to pretend to Wisdom instead of Industry, this is to forsake the Path of Vertue which is open before us, and to strike out new Tracks wherein we are interrupted at every Step by insurmountable Difficulties. 'Tis to resist the Order established by Wisdom itself: This Wisdom shines bright enough to guide us to our Welfare, but as yet has not dissipated all the Shadows; and when it has even added Revelation to Reason, its Intention was to clear up any Doubts we may entertain with Respect to the Way we ought to proceed in, and not to lift up the Vail that deprives us of the true Knowledge of Things. That Period is not as yet arrived.

But if it be very just and necessary The real Advantages of Reason. to be sensible of the Insufficiency of Reason in certain Points, and to submit without repining to the Law of him who has regulated all Things according

according to his own good Pleasure, it is still equally just to know the Value of this Reason, and exercise it according to its Extent and Ability. Next to Faith, which without reasoning, informs us of what we are to believe, to do, and hope for, we are possessed of no Treasure more precious than Reason. If this does not penetrate to the very Depth and Nature of Objects, at least it is sensible of their Excellence, and qualifies us to consider them without Confusion : It beholds their Exterior, and is conscious of their Operations and Effects ; it discerns their Relations and Number ; their Agreements, Properties and Usefulness : In a word, if it be not furnished with very clear Ideas, it has at least distinct Perceptions which it improves to a wonderful Advantage : It enjoys its Priviledges, and acts with the Precaution of a Traveller, who, as he passes along, takes Notice of what is peculiar to every Country, and knows the Roads, the Inconveniencies and Accommodations ; and, without stopping at any particular Place, observes and makes Use of the Whole.

To have a fuller Conviction of the Excellence of our Reason, and the strict Obligation we are under of improving

proving it to all possible Perfection, we need only compare it with what we have most active and accomplished on Earth, and consider the Rank it holds there, and the Functions it performs.

When we examine the various Animals with which Nature is universally peopled, we discover in them all a certain Industry and just Precaution in the Means they chuse for nourishing and rearing up their Young. They have an Imitation of Reason, because all their Actions tend to a particular Point; and we cannot mistake in them the Operation of an infinite Wisdom and Power which has varied their manner of Life, and imprinted on each Species a Method of proceeding which is never disconcerted: However, we are not to suppose them possessed of Understanding. They are intirely destitute of Reason. That Wisdom by which they act, and which directs their Motions, resides elsewhere: If they had it in themselves; if they thought and reasoned, we should not see them embarrassed, stupid and intractable when they are taken out of the Way of Life, which is peculiar to each Species. If a Spider had all the Skill of a Weaver, she would make something else besides her Web. Were the Swallow

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as skilfull as a Mason, she would build with other Materials than Morter. Were Animals once capable of Thought, they would not be limited to one invariable Track, and new Ideas would be infused into their Minds. The Principle of Reason would not be unfertile in them; it would discover itself by an Air of Curiosity; by new Efforts, and new Works; and the Variety of their Thoughts would not fail to diversify their Industry. It is quite otherwise with Respect to the Industry of Man; he has not received, like other Animals, an Impression of Habit and Vigour for producing a uniform Operation, by proportionable Organs. The Reason of Man is an active and fruitful Principle, which knows, and would be perpetually enlarging its Attainments; which deliberates, wills and chuses with Freedom; which operates, and, if I may use the Expression, daily creates new Works. This Reason has even led Men to imitate the Fabrick of the World, in a Sphere that regularly exhibits its Movements and Revolutions, and it procures to him something still more Beneficial and Noble: It makes him acquainted with the Beauty of Order, to the End that it may be the Subject of his Admiration,
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and that he may relish and observe it in all his Performances. He can even imitate the Deity, and his Reason makes him the Image of that Deity upon Earth.

It not only makes him acquainted with the Exterior, the Beauty and Value of every Object, but likewise gives him the real Enjoyment thereof. It is this Reason which constitutes him the Master and Monarch of all the Earth, and puts him into the Possession of his Empire.

'Tis true, indeed, Man is not invigorated with the Agility of Birds, who are every Moment wafted by their Wings to a large Distance. He is not fortified with the Strength of Animals, who are armed with Horns, and strong Talons, and destructive Teeth; much less is he array'd, like them, by the Hands of Nature; he neither comes into the World with Furs, or Plumes, or Scales to defend him from the Injuries of the Air. Does such a Destitution comport with the Lord of the Earth? But he has received the Gift of Reason, and is therefore rich and strong, and plentifully accommodated with all he wants. This informs him that whatever Animals enjoy is for his Use; that in Reality they are his Slaves; their
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Lives and Services are at his Disposal. Is he desirous of Game for his Regale? He dispatches his Dog or Falcon, who are trained up for that Purpose, and, without any Trouble of his own, he is accommodated with all he wants. Would he in one Season change the Habit that cloaths him in another? The Sheep resigns to him his Fleece, and the Silk Worms Spin for his Use a more light and gorgeous Robe. The Animals sustain him, and keep Centry at his Door; they combat for him; they cultivate his Lands, and carry his Loads.

Nor do the Animals alone lend him their Agility and Vigour: Reason makes the most insensible Creatures contribute to his Service; it causes the Oaks to descend from the Mountains, and forces the Stones to start from their Quarries to furnish him with an Habitation. Would he change the Climate, cross the Seas to distant Lands, and either carry any of his Superfluities thither, or bring back from thence what he wants? He makes the Mobility of the Waves and Winds subservient to his Designs. Reason places the Elements and Metals in subjection to his Necessities; and every Object around him is submissive to his Laws.

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As inconsiderable as he is in Bulk, his Reason furnishes him with a Power which is only bounded by the Earth he inhabits; his Desires are accomplished at each Extremity of the Globe; and, if I may use the Expression, he brings these together when he pleases, and establishes an Intercourse between them without stirring from his own Habitation. He paints his very Thoughts in Writing, and his Letters, without any Trouble to him, are circulated through Nations, and intimate his Will to a People three thousand Leagues distant from him. He corresponds with the whole Earth, and after his Death, is even capable of entertaining the latest Posterity. It is impossible to pursue Reason through all her Wonders; she enriches and adorns every State, and I think her as admirable in the Fingers of Artists, where she proves a Source of Beauties and Accommodations, as she is in the Discourse and Writings of the Learned, where she appears an inexhaustible Treasure as well of Instructions and Relief, as of Consolation and Pleasure.

To such valuable Productions and precious Advantages Reason joins a Set of Privileges that still enoble her the more. She is the Center of the Works

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of God on Earth; she is their End and constitutes their Harmony. Let us take Reason but a Moment from the World, and suppose Mankind destitute of her Influence, all Union would cease to subsist among the Works of the Deity, and a general Confusion be introduced through the Whole. The Sun enlightens the Earth; but this Earth is insensible, and wants none of that Lustre. The Rains and Dews, aided by the Warmth of this amiable Planet, give Vegetation to the Seed, and cover the Fields with Harvests and Fruits; but those are all lost Riches, and there are none to gather or consume them. The Earth, I confess, will nourish the Animals; but these Animals are insignificant for want of a Master to exercise their good Qualities, and concenter their Services. The Horse and Ox have Strength sufficient to enable them to draw or carry very weighty Loads; their Feet are armed with Horn, capable of resisting the most rugged Ways; but they neither needed so much Force, nor so strong a Horn to qualify them for grazing in the Meadows where they seek their Pasture. The Sheep is charged with the Weight and Impurities of her Fleece. The Cow and Goat are incommoded with the Abundance of
their

their Milk. Disadvantage or Contradiction reigns through the Whole. The Earth encloses in her Bosom Stones fit for Building, and Metals proper for the Formation of all Sorts of Vessels. But she has no Guest to lodge, nor any Workmen to employ these Materials. Her Surface is a spacious Garden, but not beheld by any Spectator; all Nature is a charming Prospect, but afforded to none. Let us restore Man, and replace Reason on the Earth; Intelligence, Relations and Unity will immediately reign through every Part, and the very Things that did not seem created for Man, but more immediately for Plants or Animals, will have some Relation to him by the Services he receives from Animals and Plants. The Gnat deposits her Eggs in the Water, and they produce a Species of Vermin that live a considerable Time before they inhabit the Air, and are the usual Sustenance of Fish and Water-Fowl. All these are made for Man, 'tis therefore to his Advantage that Gnats should exist. In the same Manner he approaches all other Beings. His Presence is the Band that connects such a Variety of Parts into the Whole; and He is the Soul by which they are animated.

In a word, Reason not only renders Man the Center of the Creatures that surround him, but likewise constitutes him their Priest; He is the Minister and Interpreter of their Gratitude; and it is by his Mouth that they offer their Tribute of Praise to him who has formed them for his Glory. The Diamond is neither acquainted with its own Value, nor knows from whom it received its Lustre. Animals are ignorant of Him who cloaths and sustains them. The Sun himself is insensible of his Author. Reason alone discovers him; and as she is placed between the Deity and Creatures that have no Understanding, she is conscious that in using these Creatures, Gratitude to God, Adoration and Love, are incumbent on her. Without her Presence all Nature would be mute; but by her Mediation every Creature proclaims the Glory of that Being from whom they have received their Existence and good Qualities. Reason alone is sensible that she is in his Presence; she alone knows what she receives from Him, and enjoys the inestimable Happiness of being able to adore Him for all that is either in or around her; and as there is Reason upon Earth, consequently there ought to be Religion, and Man should be devout
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in proportion to his Rationality. It is apparent that his Religion is only weak according as his Reason is sunk and perverted; which always happens when he obstinately desires Attainments that surpass him, or neglects to enrich himself with what was intended for his Instruction and Exercise.

This, my dear *Chevalier*, is a slight Sketch of the Advantages and Prerogatives of Reason; and they are, doubtless, so considerable, that Man, far from having any Cause to complain of his Condition, ought to be surprized at the prodigious Variety of Informations and Productions he is capable of accomplishing. And the more sensible he is of the Dignity and Excellence of Reason, the more he perceives the Necessity of cultivating and improving it. But the capital Point wherein this Cultivation consists, is to be constantly exercising our Faculties on Objects suited to their Power, and which may make us better and more happy.

Let us judge of our proper Behaviour on a thousand Occasions, by that which we ought to observe in a single Instance. Nothing is more lovely than the Light, nothing more worthy to exercise our Understanding than that

Object which gives Beauty to all Nature. Let us inform ourselves, at least then, of one Part of what may be known of it, and especially of what may be known to Advantage. But to make the Thing more intelligible, we shall use a very familiar Image.

I find myself in a Stage Coach with two Philosophers whose Sentiments are almost diametrically opposite. We will suppose our Journey began long before Day, and that all the intervening Time was passed in Sleep or Dissatisfaction; but at last the Dawn appears, and we are all awake: Some Reflections on the inestimable Benefit of Light and Colours create a Dispute between my two Philosophers, and give them an Opportunity of reasoning on the Nature of Light: One pretends not only to explain what it is in itself, but likewise our own particular Idea of it. His Adversary finds both the one and the other unintelligible; and concludes with observing, that Man in his whole Extent is not above six Feet high, and two in Thickness, and yet fancies he has a real Idea of ninety, or an hundred Feet; of the Extent of a Plain, or the Distance of the Stars from our Earth. From whence he observes, that it being a manifest

nifest Absurdity to affirm, one can have in himself the real Idea and Measure of an Object by which he is exceeded in Dimensions, it must consequently be impossible to see, and that there is no Vision in Effect, that every thing is absurd and uncertain, and that he himself is not even sure whether he is in our Company or not in the Coach. I listen to them both, and when the Warmth of the Argument is a little abated, they appeal to my Decision. Gentlemen, say I, permit me to acquaint you with my Sentiments without Reserve. The Discourse began with enumerating the Advantages and Use of Light and Colours; and you turn your Eyes from a very plain Question, whose Solution is very obvious, to cast them on two Labyrinths of Difficulties that are immaterial to the present Affair.

One of you, being accustomed to hesitate on no Point, pretends to explain the Nature of Light, and the Idea we entertain of it; the other, habituated to doubt of every thing, is not even certain that he sees the Day. One would know what, in all probability, is concealed from us; the other would be ignorant of what we really perceive. Let us rather observe a Medium, and rather

endeavour to know and improve what we have in our Power, than pursue what is forbidden, or let what we possess be useless. What would you think, Gentlemen, of two young Apprentices to a Clockmaker, who having received from their Master, Brass and Tools to make a Wheel, should spend the Day in disputing on the Nature of the Metal put into their Hands? Their Master might justly say, You are employed by me, Lads, to work and not dispute; don't give yourselves any Trouble to examine what that Brass may or may not be, whether it be compact or durable, or brittle and unfit for my Work; 'tis my Business to give you proper Materials and Tools, and yours to make me a good Wheel, and not mispend your Time. You Philosophers sometimes give in to the same Inconvenience. Light and Colours, that are the Subject of your Dispute, were intended to conduct us, and not to be the Matter of our Disquisitions and Disagreements in Opinion. We would willingly penetrate into all its Properties, because we find ourselves curious; or else deny its Existence, because the Nature of it proves incomprehensible. These are two Extremes equally discommendable.

mendable. Let us enjoy Light and Colours without making too deep Researches after what they are in themselves; or if we have an Inclination to reason on that Subject, let it be proportioned to our Capacity, and always with a View of some new Advantage; and so without knowing the Nature either of Light or the Glass through which its Rays are transfused, we may make the Glass and modify the Passage of the Light in such a Manner as to assist the weakest Eyes, cause the most distant Objects to approach us, and magnify those whose Minuteness withdraws them from our View. This is a laudable Manner of exercising our Understanding and Hands with Regard to Light: Or if we will confine our Minds to Speculations and Reasonings, let us chuse such as may enrich that Faculty with some undeniable Truths that will improve us by affording us better Informations, and making us more affected with what we have received.

For Example, if we only consider the Use of this Light, which was the Point in Debate between you, Is there not a visible Design in it, a charming Grandeur and Beneficialness? A Moment ago all Nature was plunged in
Darkness,

Darkness, every Object was dead to us, since the Gloom deprived us of their Use: But the Re-appearance of Light, in some measure, raises Nature from Annihilation, and restores its Benefits to Mankind. But this alone is not sufficient to make Objects distinguishable; were they all of the same Complexion, they would be confounded by the Eye; they are cloathed with a Livery, or rather bear a Ticket that renders them distinct; and, by their Surfaces, easy to be distinguished and perceived, which saves Mankind the Labour of long Searches, and the Uncertainty of the Reasonings he would otherwise make on their various Natures, that he might not confound them: But amongst Colours, some are soft and friendly to the Eye, as Green; others melancholy and languishing, as Brown or Black; some lively and dazzling, as White and Red: And if a large Quantity of these two last Colours were shed over the Surface of the Earth, our Sight would have been fatigued. Did Black frequently make its Appearance in Nature, it would have arrayed her in Mourning; but let Green be generally unfolded, the Eye will be aided and refreshed without our knowing the Reason;

Reason; and therefore we see that the same Creator who formed the Eye, has diffused over Hills, and Plains, and all Nature around us, that soft and smiling Verdure which is so accommodated and convenient to the Sight, and yet that he might not by too universal a Green defeat the general Intention of distinguishing Objects, I observe, that the Verdure of a Meadow differs from that of sowed Land; that every Tree and Plant has its peculiar Tinge, and the Shadings of the same Colour diversify in such a Manner the Habit given to each Body, that they are all known and easily distinguished.

These are the first Thoughts that occur to me on the Subject of Light, and by which I endeavour to reclaim my Travellers from Presumption and Uncertainty to plain and palpable Truths; and such are those which are presented to us in all we see, provided we constantly confine ourselves to what is simple, beneficial, and necessary, equally avoiding the Extremes of perpetually creeping when we have Wings to raise us, and immoderately soaring when we are once aloft.

All that has been said may be reduced to a Maxim easily retained and practised.

practised. With respect to all created Things that rise to our View, there are but three Particulars wherein we can fix a Determination: One must be a Resolution to know nothing; the second, a Desire to comprehend the Whole; and a third, an Inclination to search after and improve to the best Advantage whatever we are capable of knowing. The first Determination is a piece of Indolence that runs into meer Stupidity; the second is a Temerity which is constantly punished; and the third is a Resolution of Prudence, which, without aspiring to what surpasses the Capacity of Man, is exercised with Modesty, and gratefully uses what was made for our Enjoyment.

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